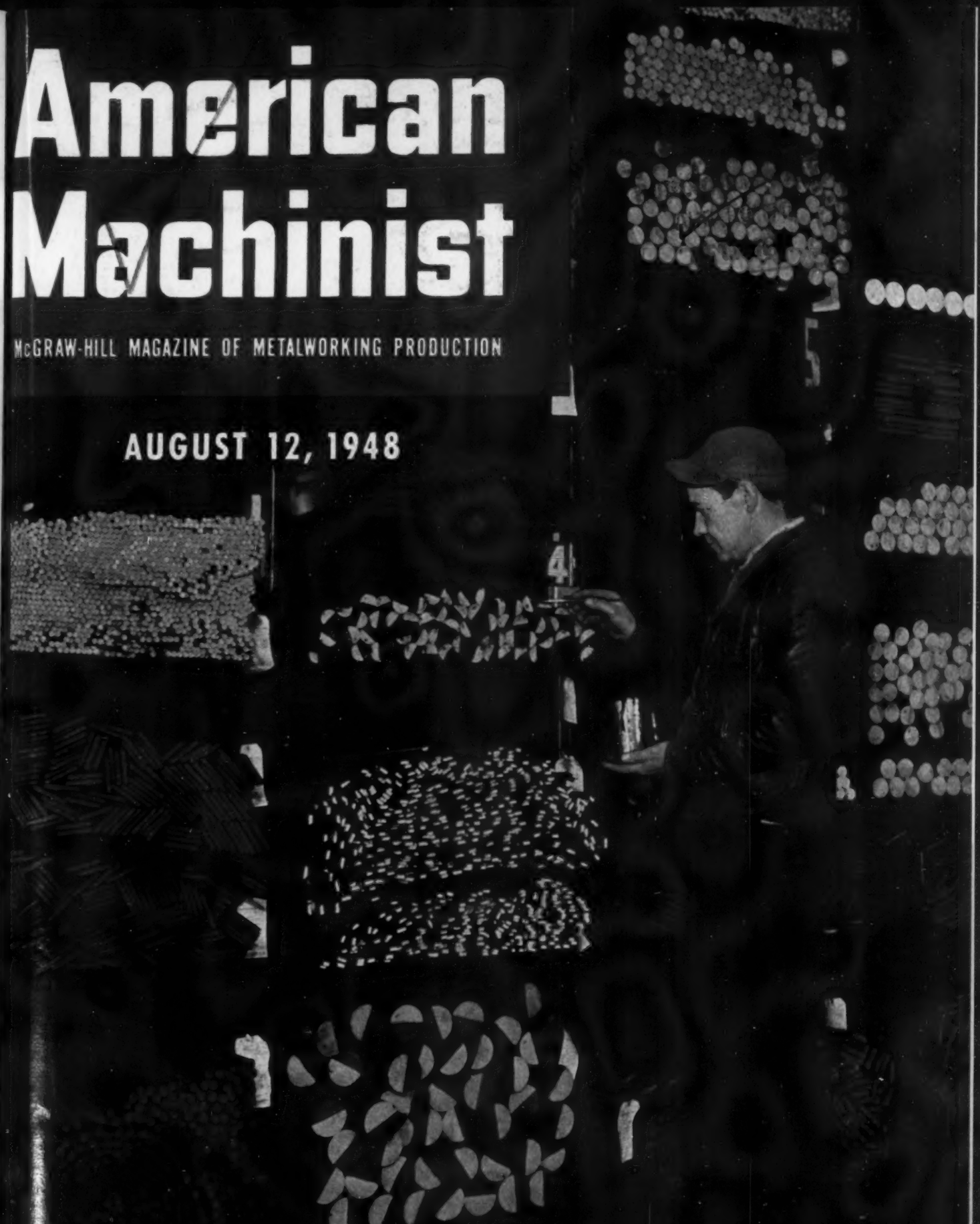
American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

AUGUST 12, 1948



Colors and Bins Identify Raw Materials

Hydraulic Units Power Machine Feeds

Is Metalworking Moving?—SPECIAL REPORT

FOR YOUR

EXTRA LARGE WORK

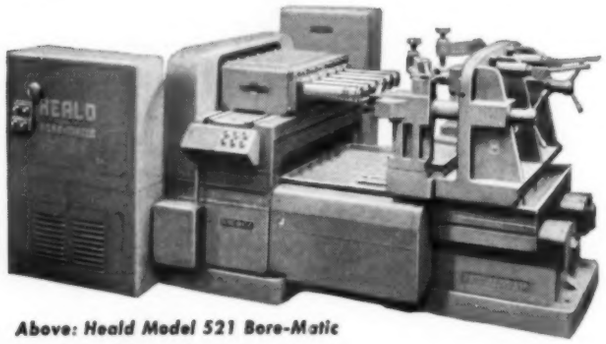
TWO BIG, NEW HEALD BORE-MATICS

➡ Model 521 • Single End

➡ Model 522 • Double End

Now you can get the same high standards of precision on extra-large work as on smaller parts . . . with the new Heald Model 521 and 522 Bore-Matics. Massive and powerful, these heavy-duty machines incorporate all the advantages of the new Bore-Matic line—*all new features* that *cut costs, increase production* and *improve accuracy*.

The single end Model 521 is ideal for such big work as cylinder blocks, pump and compressor bodies, connecting rods, etc. The Model 522, with its double-end design, permits boring holes with exact alignment or spacing in large workheads, tailstocks, spindle carriers, frames, housings and similar parts.



Above: Heald Model 521 Bore-Matic
Below: Heald Model 522 Bore-Matic

These new Heald Bore-Matics provide ample capacity to handle a wide range of extra large work. Bridges are 47" wide and will accommodate up to 7 boringheads. Tables are low—only 22" from floor—and are 36" wide. Fixture pad size is 28" by 32" on the Model 521, and 28" by 40" on the Moael 522.

We'll gladly explain how these new machines can finish *your* large work better, faster and at lower costs. Contact your nearest Heald representative or Worcester today.

THE HEALD MACHINE COMPANY

Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton
Detroit • Indianapolis • Lansing • New York

HEALD

TECHNOLOGY DEPARTMENT

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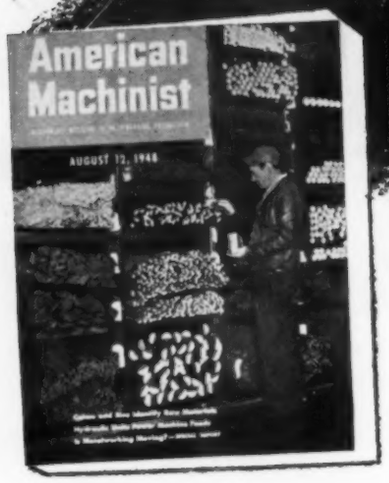


Chips & Quips

Our Cover . . . Power transmission and conveyor chain produced at Link-Belt's Ewart Plant in Indianapolis is made to close specifications for strength and other characteristics. So careful segregation of all incoming material is essential. Steel rods and bars are stored in special racks until needed by production departments. In addition to chemical and physical tests of the steel, each piece is spark-tested, then color-coded on one end. Kodachrome by I. H. Schafer of Bass Photo Co. shows George Hargis finishing some coding. Special racks, which simplify segregation storage of 10-, 12- and 14-ft. rods and bars, are described by R. O. Fristoe, Plant Engineer, in this issue.

Machine Design . . . L. W. Court, works engineer of the Richmond Works, International Harvester, describes more than a dozen applications of hydraulic elements on machines in his plant. Feeds are assembled from purchased parts and usually of the low-pressure type. . . . In this issue also are descriptions of a cutoff machine rebuilt from a resistance welder, and a recent transfer machine which produces two gear-shift housings at once. . . . Also we describe use of raising blocks to increase capacity of radial drills—sort of a "stilts" idea.

Coming . . . Lockheed has, a working job evaluation system covering men up to $15,000 per year. We describe it in our Aug. 26 special report. . . . Also in that issue are: a new press-repair process, centrifugal investment casting, tooling for stainless skimmer disks, and a variety of tooling ideas.

Grinding . . . Hans Branders, of Karhula, Finland, has explained for us how operation sketches and detailed instruction sheets help carbide-tool grinders do a good job. Many of his ideas are just as applicable in the United States. . . . Also on grinding is a description of finishing of Alnico rotors at G.E., West Lynn, written by Ralph E. Roberts of the General Methods Section. . . . Then E. C. Bleam, abrasive engineer with Simonds Abrasive, gives pointers on wheel, abrasive, adhesive and wheel set-up for low-cost polishing.

Bad Stewardship . . . In *A.M.* for June 17 (page 116), we showed use of chain and belt conveyors at Stewart Die Casting in Chicago—but the printed page read "Steward." While the word "Stewart" in the subhead and your own knowledge of company names undoubtedly signalled the error in typesetting, we wanted to make sure you had the right name in mind. . . . Which reminds us that editors eventually develop an innate fear of the typographical error. In May 20 "Chips," for example, we smiled in print over a letter we received addressed to "Mr. E. Meritus"—undoubtedly intended for Editor Emeritus Colvin. Our smile vanished, however, when the magazine was delivered, because in that item, the printer had spelled "sales" like this: "asles." You can't win!

Nice "Little" Chip . . . A Bridgeford lathe at Erie City Forge Company, turning a crankshaft throw, produced this chip—about 5/16x2¼-in. in cross-section. The shaft was steel, with 0.40-0.48 carbon and 0.04-0.06 vanadium. The tool was H.S.S. made by Apex Tool; cutting speed 40 fpm.

INDUCTION APPLIER . . . Ben Griffith joined the Allis-Chalmers Mfg. Co. in 1944 after receiving his degree from the University of Colorado. He completed the company's Graduate Training Course, and has since specialized in induction heater design and application. While he is currently engaged in research work on sand-core drying with the dielectric heater, he took time out to prepare our current special report on work coils for induction heating, working with . . .

BEN H. GRIFFITH, JR.

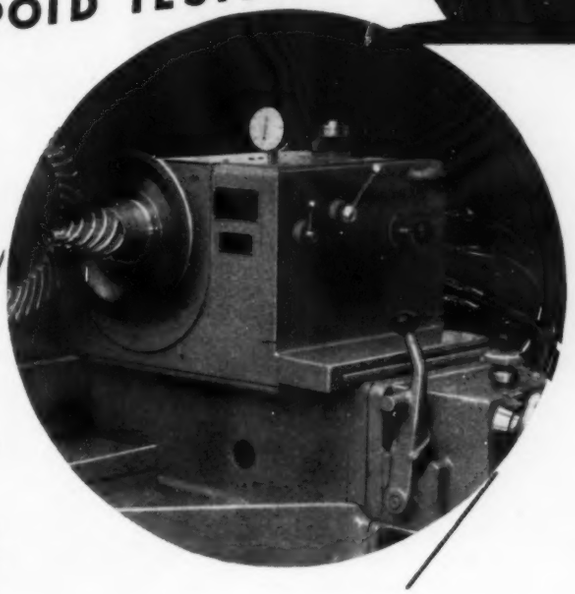
ELECTRONIC DEVELOPER . . . Ray Skiba, after 20 years in the electronic and radio field, joined Allis-Chalmers in 1944 to do construction and development work on the company's 100-kw. induction heater. In 1946, he became supervisor of the A-C Electronic Processing Laboratory, where he was responsible for building work coils of every conceivable shape and description. During this time, Mr. Skiba also helped develop control equipment for the company's 20-million-volt betatron. He is now supervisor of the A-C Electronic Development Section.

RAY SKIBA

SIMPLIFIED TESTING

WITH THE NEW GLEASON NO. 17A HYPOID TESTER

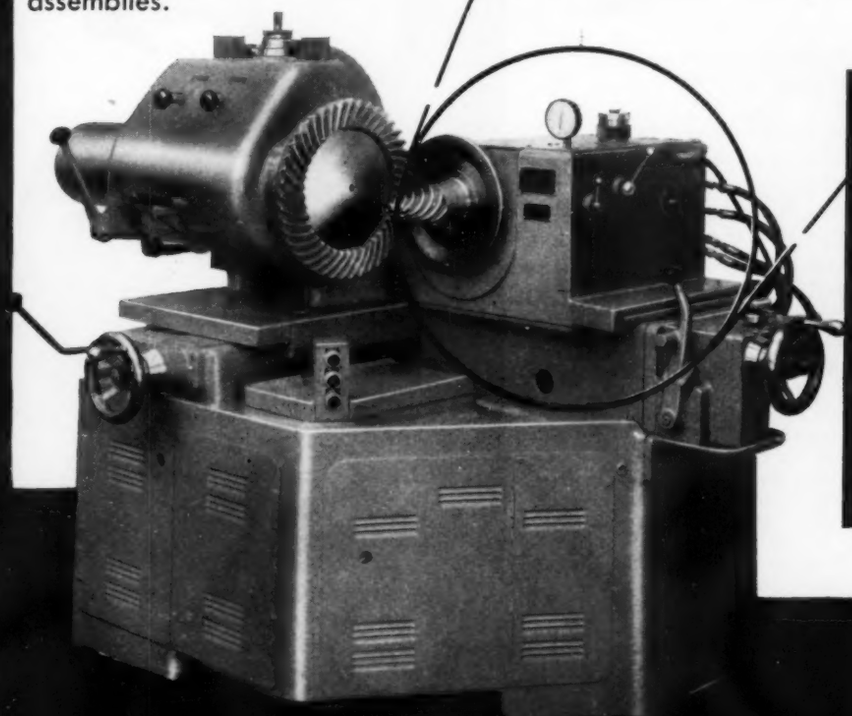
A running test, simulating actual operation of gears in final assembly, is the only positive method of determining how gears will operate in their final mountings.



BEFORE PRODUCTION—to establish the correct setup for the gear cutting machine.

DURING PRODUCTION—to maintain uniform quality of the cut gears.

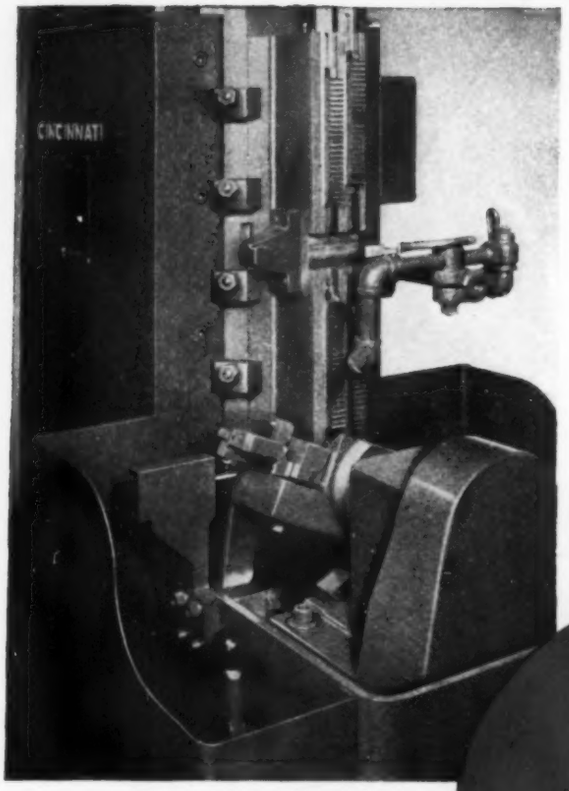
FINAL TEST—to find the best running quality of the gears for assembly . . . eliminating costly fitting or tearing down and rebuilding of assemblies.



Correct mounting may now be read simply and easily from an indicator with the New Gleason No. 17A Tester. Designed with a dial adjustment which once set up, automatically duplicates backlash on each pair of gears, this machine simplifies obtaining the best running position of gears in final assembly.

GLEASON *Works*
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years



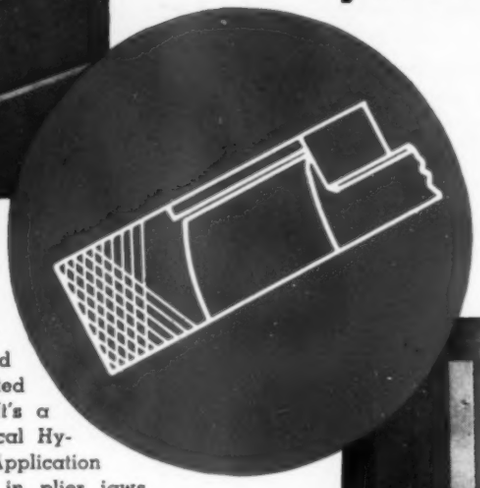
First step—Loading position for two plier sections.

CINCINNATI

CROSS-HATCH SERRATIONS

broached in single stroke

of Hydro-Broach ram

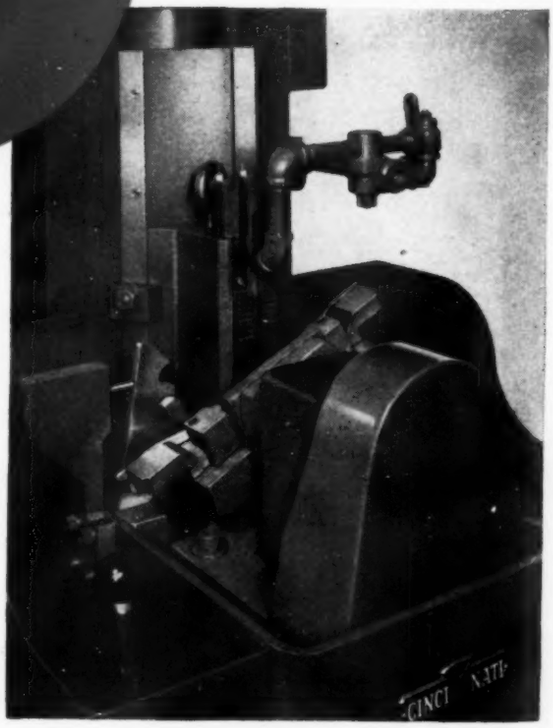


Drawing of serrations broached in plier jaws. Sequence of operations: Load two parts and start . . . broach, index, broach . . . remove two parts and return ram. Production 460 per hour.

● Take the cost reduction usually offered by broaching, double it, and you have an idea of the saving effected by the equipment illustrated here. It's a CINCINNATI No. 1-30 Single Ram Vertical Hydro-Broach, tooled up by Cincinnati Application Engineers to broach the serrations in plier jaws.

In one stroke of the ram, two serrating operations are performed, resulting in the cross-hatch effect illustrated in the drawing.

Here's the way it works. A space between the two sets of broaching inserts, shown in the photograph above, provides an interval of time, during the downward stroke of the ram, to automatically index the fixture from one cut to the next, teeter-totter fashion. ¶A Cincinnati development, this principle is known as "split-stroke" broaching. It's one of many innovations in low cost broaching instituted by our engineers. Perhaps it will give you an idea involving two or three operations in your own shop, which could be combined at a big reduction in cost. Our Application Engineers are at your service to work out the best method and recommend the proper equipment. Send blueprints of parts when you write for particulars.



Second step—Position of fixture after ram descends halfway.

It's new! In one conveniently indexed catalog, you have a summary of the complete CINCINNATI line. Machine tools: milling, broaching, diesinking, cutter sharpening, optical projection profile grinding, precision grinding, lapping. Flame hardening machines. Cutting fluid. Write for a copy, M-1646.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

CINCINNATI FILMATIC

Traveling Wheelhead Roll Grinders

Grinding a paper mill roll on a CINCINNATI FILMATIC 36" x 288" Traveling Wheelhead Roll Grinder. Other standard sizes: 44", 50" and 60"

. . . Save a lot of time in the Roll Shop

Everyone expects a big, new machine to save a lot of time . . . there's no point in investing in the equipment if it doesn't. And the bigger the machine, the greater should be the timesaving possibilities. In roll shops for paper and steel mills, CINCINNATI FILMATIC Traveling Wheelhead Roll Grinders offer two timesaving features which you can't afford to overlook.

TIMESAVER NO. 1—*FILMATIC grinding wheel spindle bearings* . . Rate of grinding or stock removal means nothing to these bearings; they run for years without attention other than routine lubrication.

TIMESAVER NO. 2—*Automatic wheel balancing* . . without removing the wheel mount from the machine, this unit *automatically balances itself within a few seconds.* Hard to believe? Write for the pamphlet illustrated at the right, G-583, and see how it works.

Ask for a visit from our roll grinder specialist. He will be glad to tell you more about CINCINNATI FILMATIC 36", 44", 50" and 60" Traveling Wheelhead Roll Grinders.

If you are interested in roll grinding alone, write for pamphlet G-583 shown at left. It describes automatic wheel balancing for CINCINNATI Grinding Machines, the most important grinding development in a decade.

If you are interested in machine tools (for milling, precision grinding, broaching, lapping, diesinking, cutter sharpening, optical projection profile grinding), flame hardening and cutting fluid, write for new general catalog M-1646, illustrated at the right.

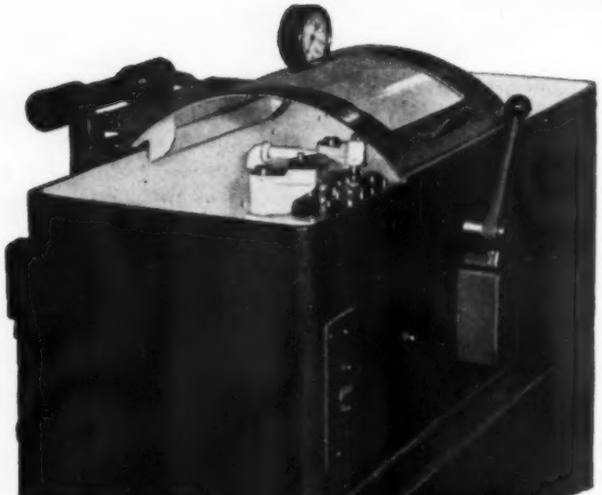
CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

Small Gears



Fine-Pitch Burnishing

For gears to be used in their soft state, particularly non-ferrous metal, 2-at-a-time on the Fellows No. 4 B Burnishing Machine speeds the work.

Fellows Shaving

Where extreme accuracy is demanded, the Fellows Fine-Pitch Shaving Machine is an ideal running mate for the small Gear Shaper. Its production with accuracy is worth investigating.

GEAR SHAPERS · THREAD GENERATORS · CUTTERS · SHAVING AND BURNISHING MACHINES

...Thousands per day!

Gear Shaper Cutting

This magazine feed, rugged and reliable, on a No. 3 Fellows Fine-Pitch Gear Shaper, produces small pinions... 600 per hour.

Precision-cut ... and Shaved or Burnished

There is no reason, now, why fine-pitch gears and pinions cannot be precision generated and finished on a production basis. The No. 3 Fine-Pitch Gear Shaper turns out tiny pinions or gears at phenomenal speeds *and at lower cost even than sub-press stampings.* Finishing on Fellows equipment attains a high degree of accuracy and correspondingly smooth tooth surfaces. Isn't it something to find out about? Ask for information on small gear production by contacting our nearest office.

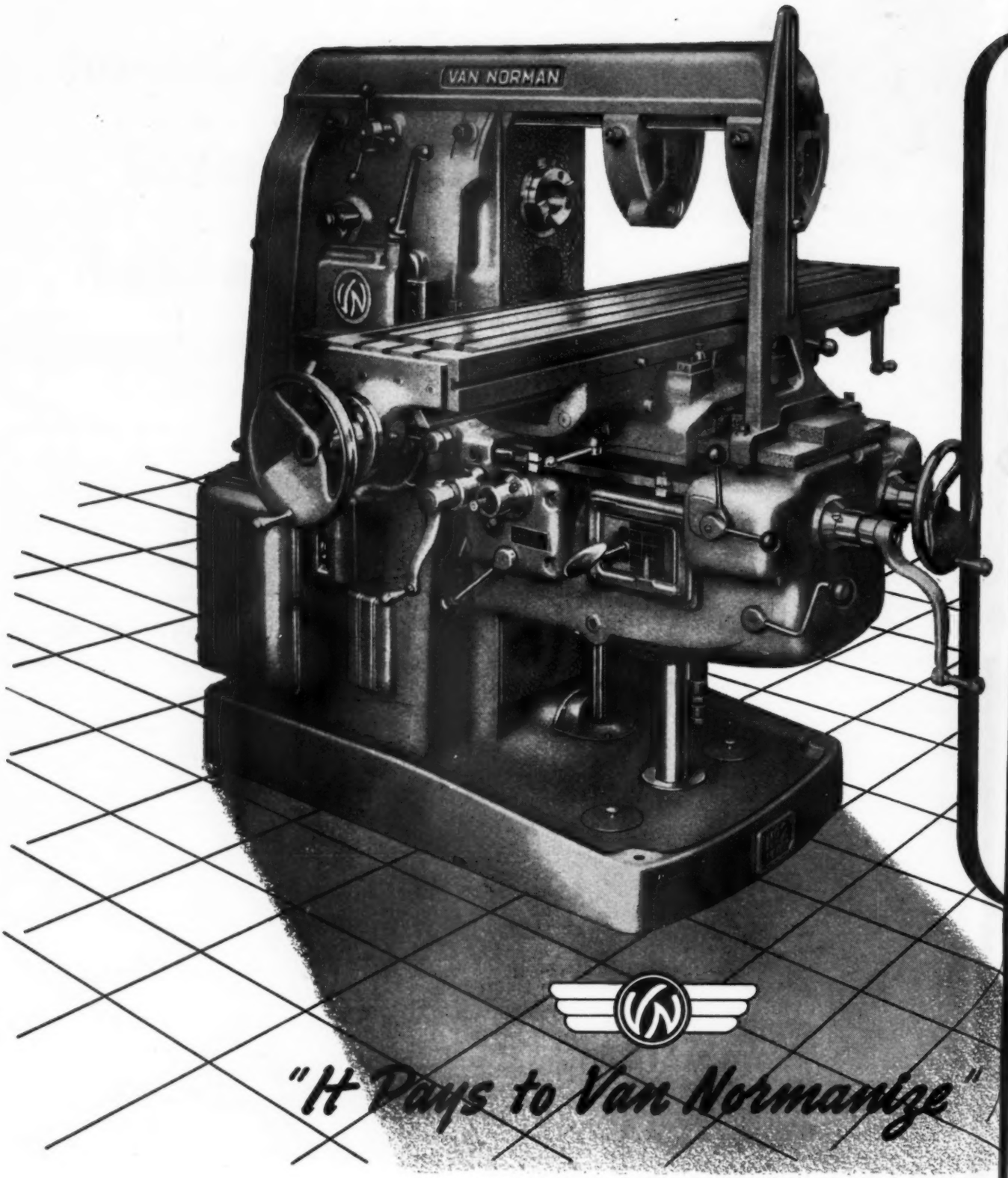
Fellows

The Fellows Gear Shaper Co., Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2, 640 West Town Office Bldg., Chicago 12, 7706 Empire State Bldg., New York I.

GEAR MEASURING AND INSPECTION INSTRUMENTS · PLASTICS MOLDING MACHINES

VAN NORMAN HORIZON

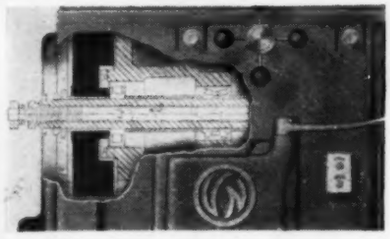
Provide Improved Cutability . . .



"It Pays to Van Normanize"

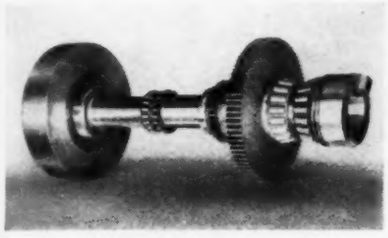
ONTAL MILLING MACHINES

Exceptional Ease of Control



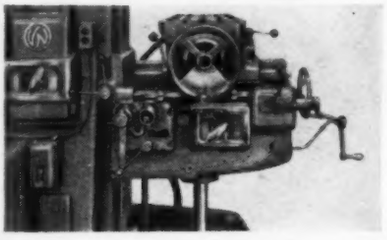
Built-in Spindle Flywheel

The Van Norman spindle design incorporates a heavy flywheel mounted inside the column. It assures uniform, uninterrupted transmission of power to the cutter because it effectually cushions by its inertia, any fluctuation of speed and power. The flywheel increases and improves cutability . . . results in a smooth finish of work surface.



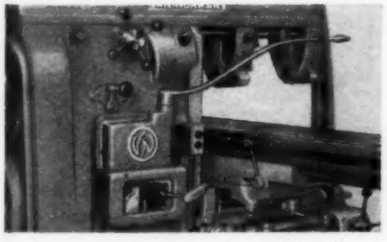
5-Bearing Spindle

The large diameter hardened alloy steel cutter spindle rotates on 5 anti-friction bearings. Large double-opposed taper roller bearings in front provide minimum overhang . . . center double-opposed taper roller bearings add rigidity. A straight roller bearing supports the rear. This construction assures maximum spindle support and rigidity under every type of cut.



Front & Rear Power Control

All power feed controls, as well as 6-way rapid traverse, can be operated from front or rear of the machine. This dual feed control simplifies operation, saves time, reduces worker fatigue. The finger tip controls are directional and can be operated either with spindle stopped or rotating.



Ease of Spindle Control

The single lever speed selector, convenient spindle reverse and spindle clutch levers are located on the side of the column for ease of control. The spindle clutch lever for starting and stopping the spindle is quickly adjusted to the desired and most convenient front or rear operating position.

From every angle, Van Norman Horizontal millers give you every advantage in cutability and ease of operation. These machines will give maximum quality service and increase production on a wide variety of general purpose and production milling. They are available in a wide variety of models and can be had with plain or universal saddles. Write for complete information.

VAN NORMAN COMPANY

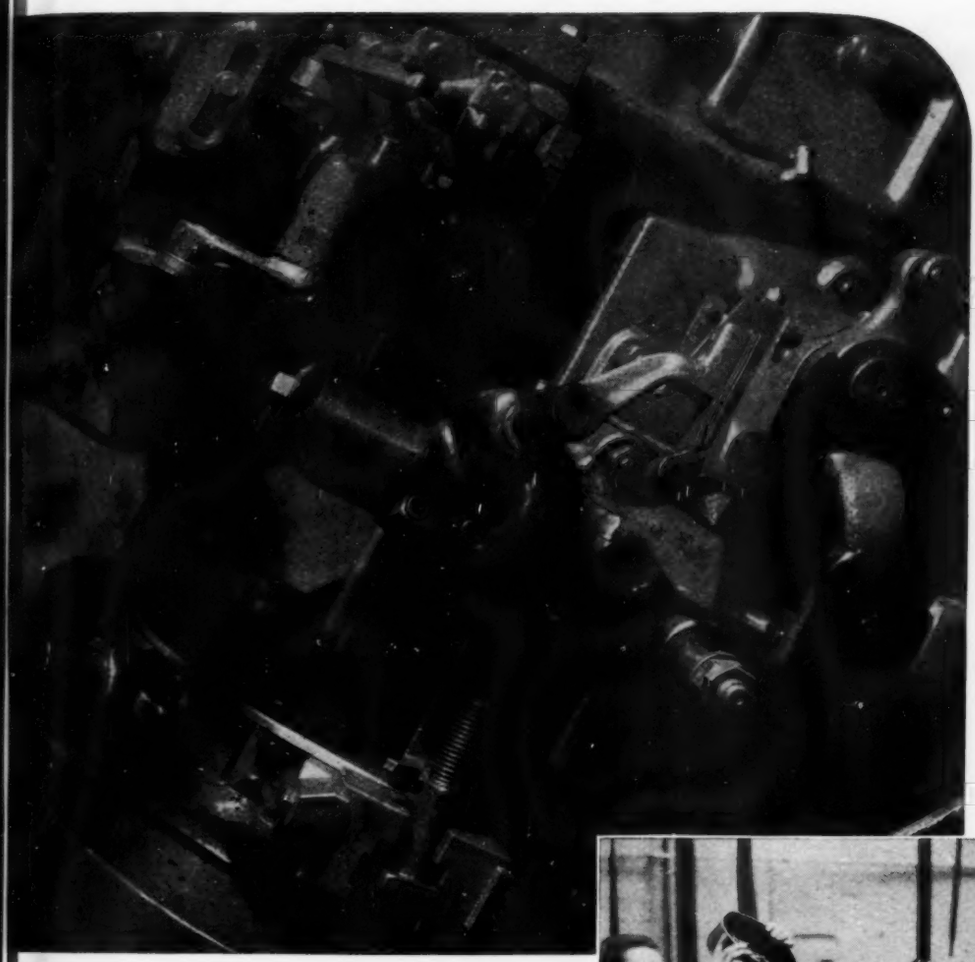
SPRINGFIELD 7, MASSACHUSETTS

LANDIS
AUTOMATIC
FORMING &
THREADING
MACHINE

High Speed
964 3/4" BOLTS

LANDIS MACHINE CO.

PRODUCTION
PER HOUR, POINTED AND THREADED



• The LANDIS Automatic Forming and Threading Machine is a fully-automatic machine designed to thread and point bolts, studs, cap screws, etc., from cold headed or hot forge blanks. The machine is built with semi-vertical spindles, thus saving space, and one man can easily operate a battery of eight machines.

Bolt blanks are dumped continuously into the hopper. The operation is then automatic until the finished bolts are ejected into an oscillating conveyor carrying them to a container.

Short set-up time is ideal for short runs—a change in thread length in 5 minutes, in bolt length in 10 minutes, in speed in 2 minutes—a complete change in diameter, pitch, thread length, and bolt length in 40 minutes.

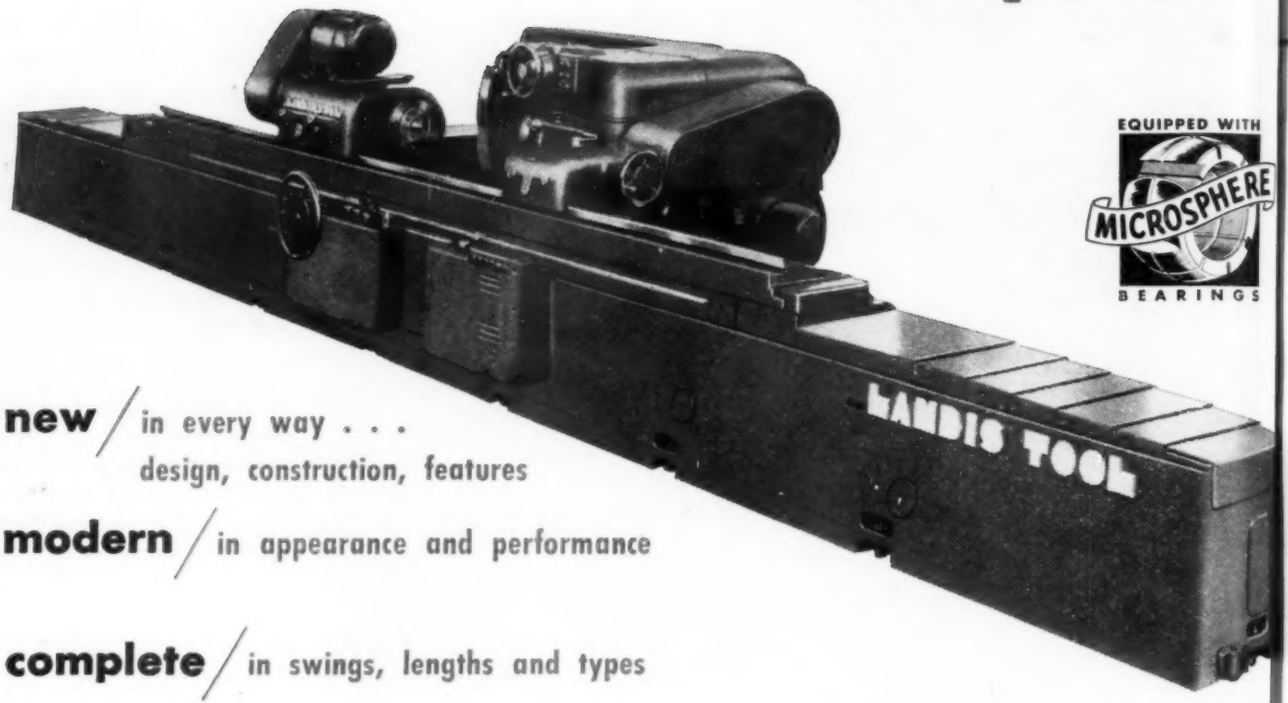
Write for Bulletin E-70

MORE BOLTS PER HOUR, PER MAN

• Output varies from 750 to 1800 bolts per hour with the length and diameter of the thread. The Landis Automatic Forming and Threading Machine is illustrated producing:—on the left, pointed and threaded ¾" machine bolts 4" long with a 10 pitch, Class 2 fit, 1" long thread at the rate of 964 bolts an hour in the plant of one of the nation's largest bolt manufacturers—in the center close-up, over 1,000 ⅞" alloy steel cap screws per hour with 20 pitch, Class 3 fit threads—on the right, bolts, ⅝"-11 pitch with 1½" thread length at 786 per hour, and over 10,000 threads per chaser grind.

WAYNESBORO
PENNA · U · S · A

new
modern
complete



EQUIPPED WITH MICROSPHERE BEARINGS

new / in every way . . .
design, construction, features

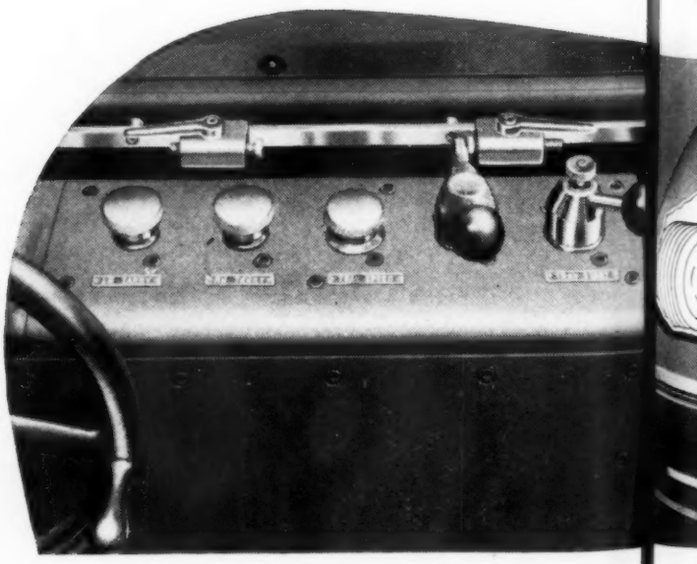
modern / in appearance and performance

complete / in swings, lengths and types

Ask for Catalog F48

Production estimates and tooling suggestions will be made on the basis of your blueprints

LANDIS TOOL
Precision Grinders



Smooth traverse and reversal

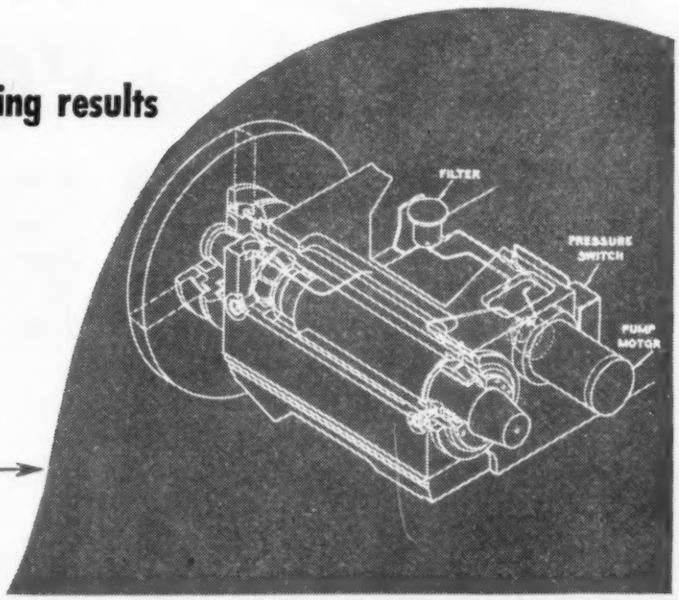
Hydraulic traverse in all lengths—centralized controls.

LANDIS TOOL type F hydraulic cylindrical grinders

Type	Swing	Lengths Between Centers	Maximum Weight On Centers
F Plain	14"—16"	36" to 168"	6,500 pounds
FF Plain	16"—20"—24"	48" to 240"	10,000 pounds
FF Plain Gap	16"—40" Gap	96" to 168"	10,000 pounds
FR Roll	16"—20"—24"	48" to 168"	10,000 pounds

features that give outstanding grinding results

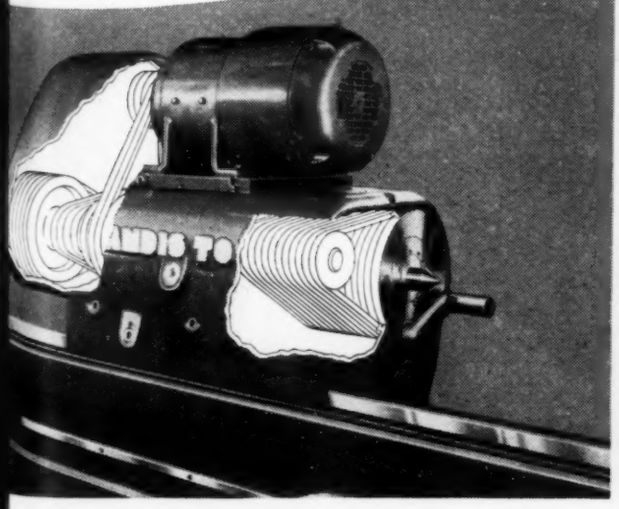
short grinding cycle

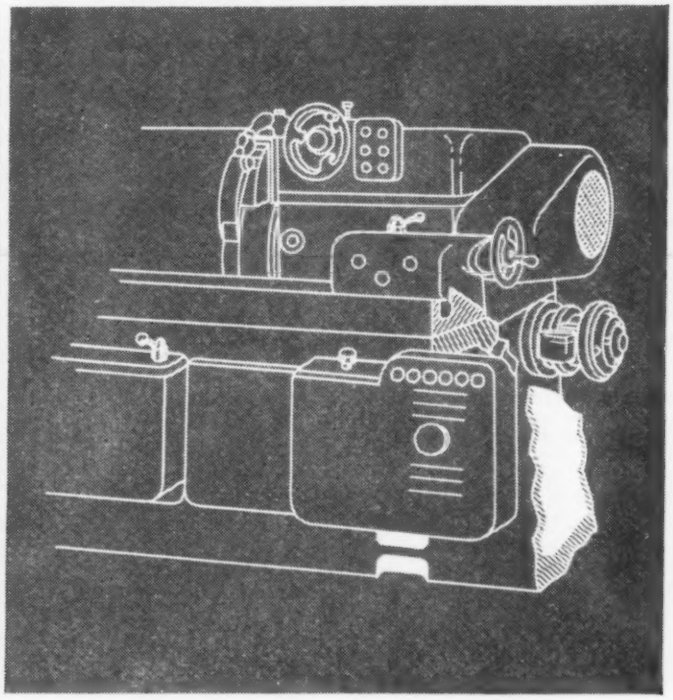


Quick sparkout period and sensitive wheel feed

Pressure Lubricated Microsphere Bearings

fine finishes





Smooth transmission of power

Complete Vee Belt drive used on headstock and wheel base.

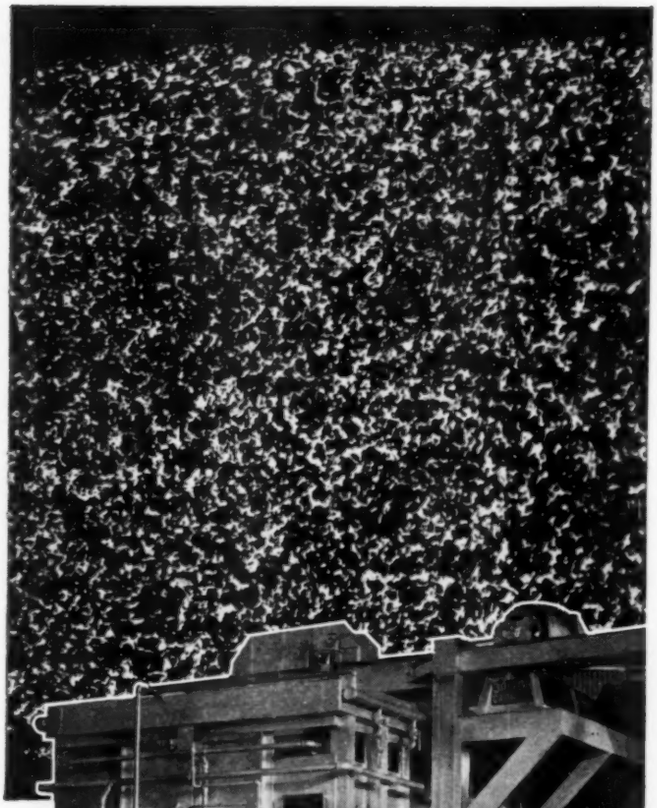
Choice of wheel feeds

Automatic hydraulic feed standard. Four other combinations of hydraulic and electric feeds available.

LANDIS TOOL COMPANY / 10 E. SIXTH STREET / WAYNESBORO, PA.

Save the Cost of

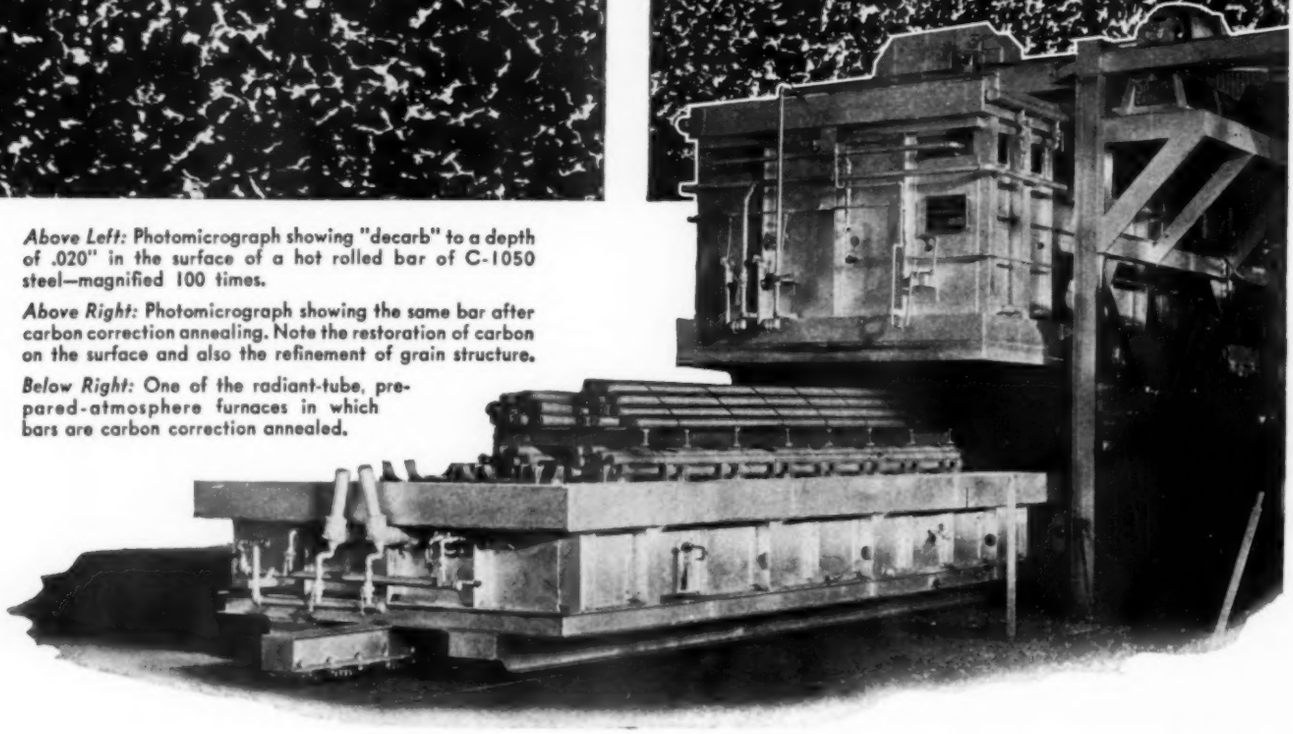
. . . USE REPUBLIC "CARBON



Above Left: Photomicrograph showing "decarb" to a depth of .020" in the surface of a hot rolled bar of C-1050 steel—magnified 100 times.

Above Right: Photomicrograph showing the same bar after carbon correction annealing. Note the restoration of carbon on the surface and also the refinement of grain structure.

Below Right: One of the radiant-tube, prepared-atmosphere furnaces in which bars are carbon correction annealed.



Removing "DECARB"

UNION COLD DRAWN
CORRECTED" BARS

If you make steel parts which are heat treated to produce high surface hardness around a tough core—particularly those parts hardened by high frequency induction heating—here's an easy way to cut unit production costs: Use Republic Union Cold Drawn "Carbon Corrected" Bars.

Through carbon correction annealing in prepared atmosphere, the carbon lost by decarburization during hot rolling is restored to the surface of the bars, permitting them to be used in the original cold drawn condition. Thus, the cost of removing "decarb"—which in a steel like C-1050 frequently means the removal of 20 thousandths of an inch or more—is saved.

Because the treatment includes annealing as well as carbon correction, steels such as C-1050 and C-1151, frequently used for parts requiring high surface hardness, also are substantially improved in

MACHINABILITY.

That's a quality which you will *ALWAYS* find in every Republic Union Cold Drawn Steel—whether it's Bessemer screw stock, a carburizing grade or a stainless steel. MACHINABILITY comes first at Union Drawn—has taken precedence over everything else in laboratory and mill for some 58 years.

Union Drawn metallurgists and engineers are ready to help YOU in using "Carbon Corrected" or any other Republic Union Cold Drawn Steel Bars to best advantage—to improve your product, to increase production efficiency, to cut costs. Write us.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • • • • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic

REPUBLIC STEEL REG. U. S. PAT. OFF.

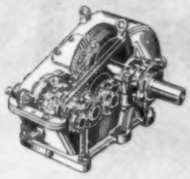
US

UNION COLD DRAWN STEELS

REG. U. S. PAT. OFF.

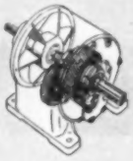
Free-Machining Bessemer, Alloy and Enduro Stainless Steels
•
Union Cold Drawn Special Sections
•
Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

OTHER TYPES OF LINK-BELT POWER TRANSMISSION MACHINERY



HERRINGBONE GEAR SPEED REDUCERS

WORM GEAR SPEED REDUCERS

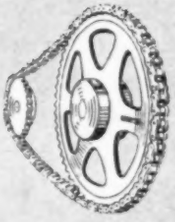


HELICAL GEAR SPEED REDUCERS

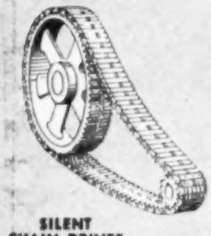
GEARMOTORS

ELECTROFLUID DRIVES

P.I.V. GEAR SPEED VARIATORS



SILVERLINK ROLLER CHAIN DRIVES



SILENT CHAIN DRIVES

STEEL AND MALLEABLE CHAIN DRIVES

V-BELT DRIVES

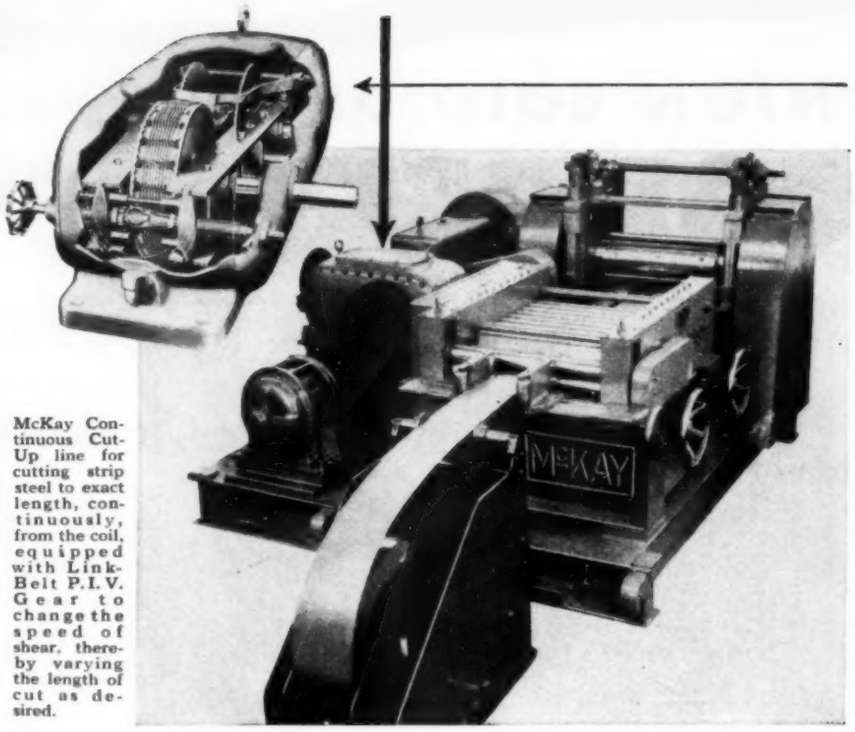
UNMOUNTED BALL AND ROLLER BEARING UNITS

ROLLER BEARING MOUNTED UNITS

BALL BEARING MOUNTED UNITS

BABBITTED BEARINGS

SELECT---*and Maintain* YOUR IDEAL MACHINE SPEED WITH P.I.V. GEAR *Speed Variator!*



McKay Continuous Cut-Up line for cutting strip steel to exact length, continuously, from the coil, equipped with Link-Belt P.I.V. Gear to change the speed of shear, thereby varying the length of cut as desired.

Wherever precise speed is a factor in any manufacturing process, the unique P.I.V. Gear speed variator gives outstanding satisfaction.

With this unit, power is transmitted positively through an all-metal chain, making tooth-to-tooth contact with metal wheels. Speeds can be varied infinitely within range of the unit and once selected, the chosen speed is maintained accurately. Speed is changed while the drive is running, by a small hand wheel or by automatic or remote control.

For precise speed control in any type of industrial application use the P.I.V. Gear. Built in a wide range of sizes, and types, fully described in Book 1874.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.

11,094 Offices, Factory Branch Stores and Distributors in Principal Cities.

LINK-BELT

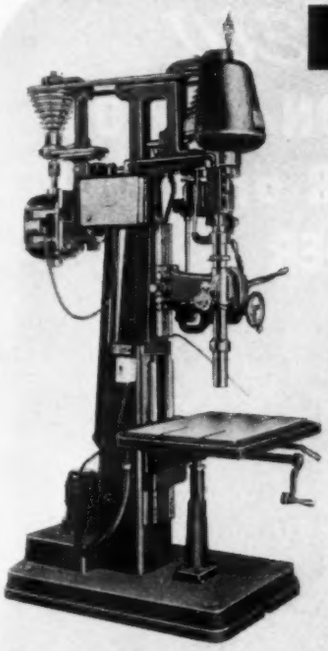
Power Transmission Machinery

C-O means GO!

For speedy, precision performance — it's C-O from the word, "GO"! Forty nine years experience in designing and producing drill presses is your assurance of advanced design, sound engineering, quality construction. Write today for insert No. 90 illustrating the World's Most Complete Drill Press Line.

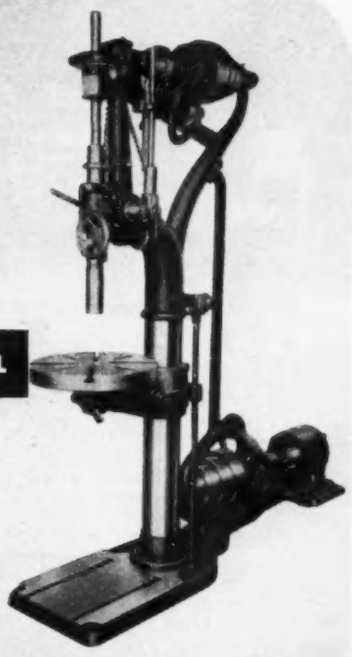
CANEDY-OTTO MEANS SPEEDY PRECISION PRODUCTION

21" BOX COLUMN FLOOR DRILL

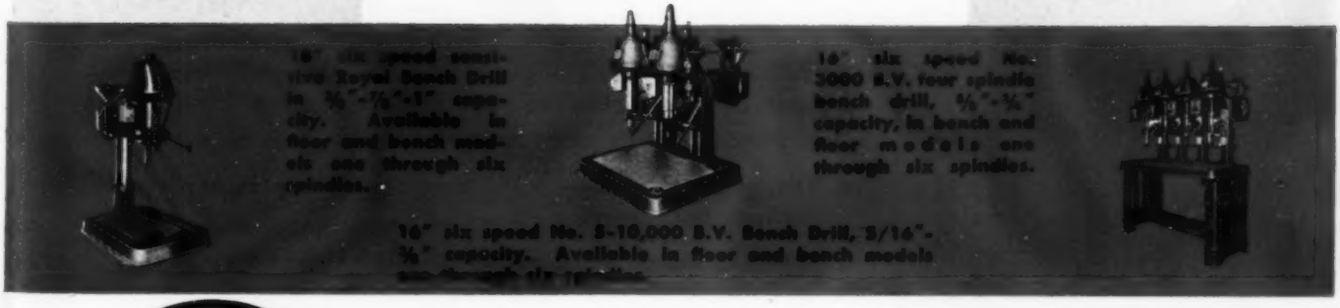


1-½" capacity sliding head drill available in 1-, 2-, 3-, 4- and 6-spindle models, of full ball and Timken roller bearing design. Eight step Vee belt drive on famous C-O tilting motor bracket gives sixteen spindle speeds. Positive geared power feed. Automatic stop. Also operates through lever, power feed or worm wheel feed. Accurately machined column, base an adjustable table.

21" STATIONARY HEAD FLOOR DRILL



Eight speed, 1-½" capacity, semi-cast one piece steel construction with lower column turned and ground. Equipped with back gears and power feed, ratchet type lever feed, wheel feed and automatic stop. Semi-cast steel table and base, well ribbed, T-slotted, accurately machined. Table revolves on column. Available with either tight or loose pulley drive for power take off, electric Vee belt, or geared motor drive.



16" six speed sensitive Royal Bench Drill in ⅝"-⅞"-1" capacity. Available in floor and bench models one through six spindles.

16" six speed No. S-10,000 S.V. Bench Drill, 5/16"-⅜" capacity. Available in floor and bench models one through six spindles.

16" six speed No. 3000 S.V. four spindle bench drill, ⅝"-¾" capacity, in bench and floor models one through six spindles.

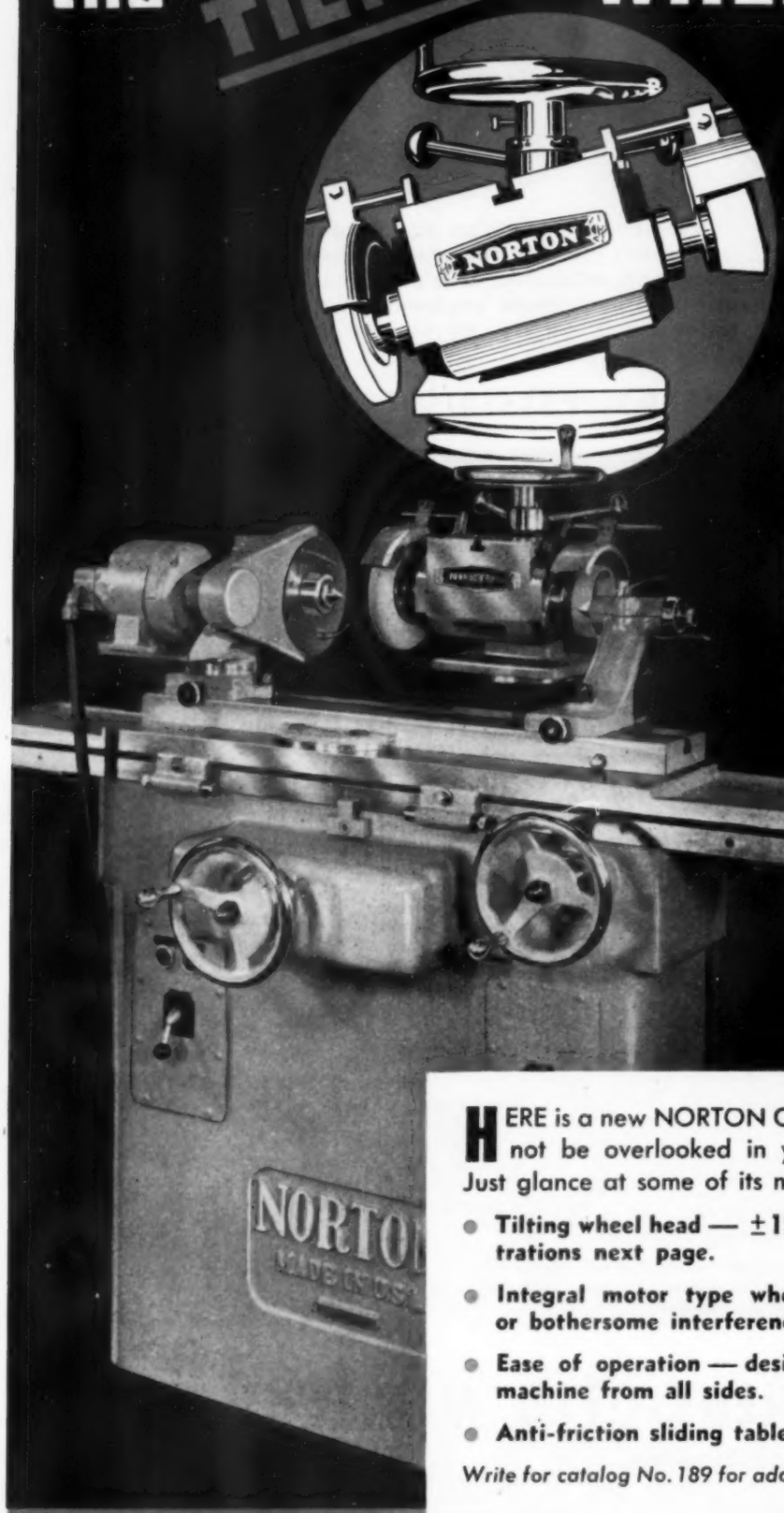
C THE WORLD OVER O

CANEDY-OTTO MFG. COMPANY

Chicago Heights, Illinois

Builders of the World's Most Complete Drill Press Line — radial drills, sensitive drills, upright drills, hi-speed drills and special drilling machinery.

the *new* TILTING WHEEL HEAD . . .



AN EXCLUSIVE FEATURE ON THE *NEW* NORTON No. 20 CUTTER and TOOL GRINDER

HERE is a new NORTON Cutter & Tool Grinder that should not be overlooked in your retooling plans for 1948. Just glance at some of its many features:

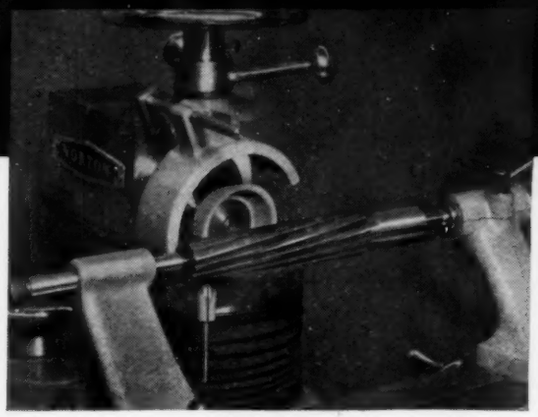
- **Tilting wheel head — ±15° from the horizontal. See illustrations next page.**
- **Integral motor type wheel spindle — no belts, pulleys or bothersome interferences.**
- **Ease of operation — design enables operator to control machine from all sides.**
- **Anti-friction sliding table — another aid to the operator.**

Write for catalog No. 189 for additional information and specifications.

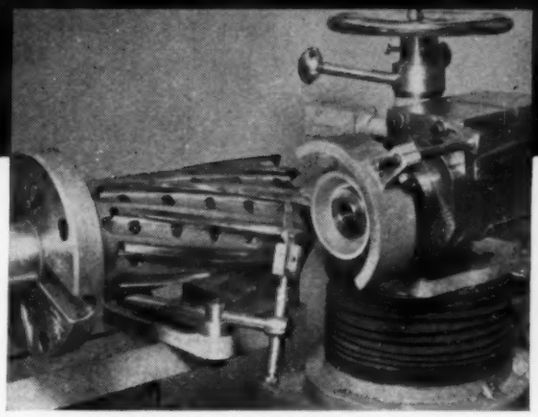
M-560

Abrasives · Grinding Wheels · Grinding and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Norbide Products · Labeling Machines

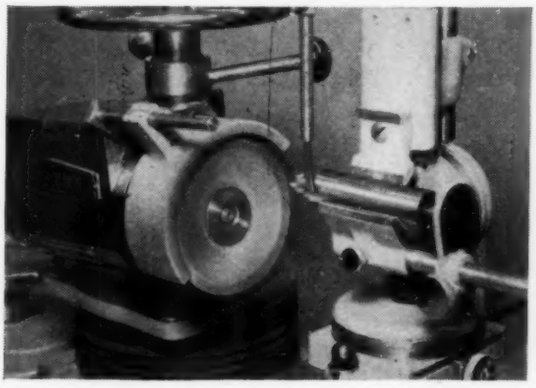
. . . simplifies many set ups!



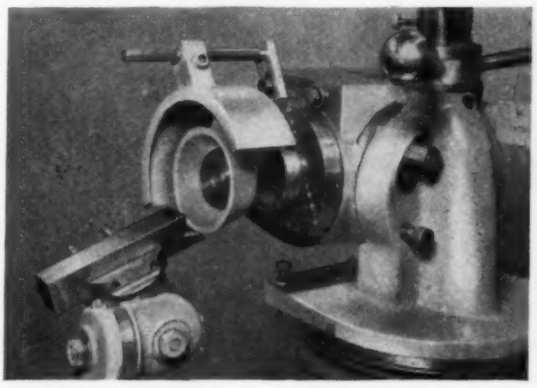
8° angle set on Tilting Wheel Head while grinding spiral taper reamer. By this method, the clearance angle is *constant* for full length. No more compromise or time-consuming "trial and error" tactics for this important job.



5° angle set on Tilting Wheel Head while grinding end of large 5 x 10" milling cutter between centers with swivel table set at 90°. Relocation of cutter unnecessary for the O.D. grind — merely reset swivel table to 0°



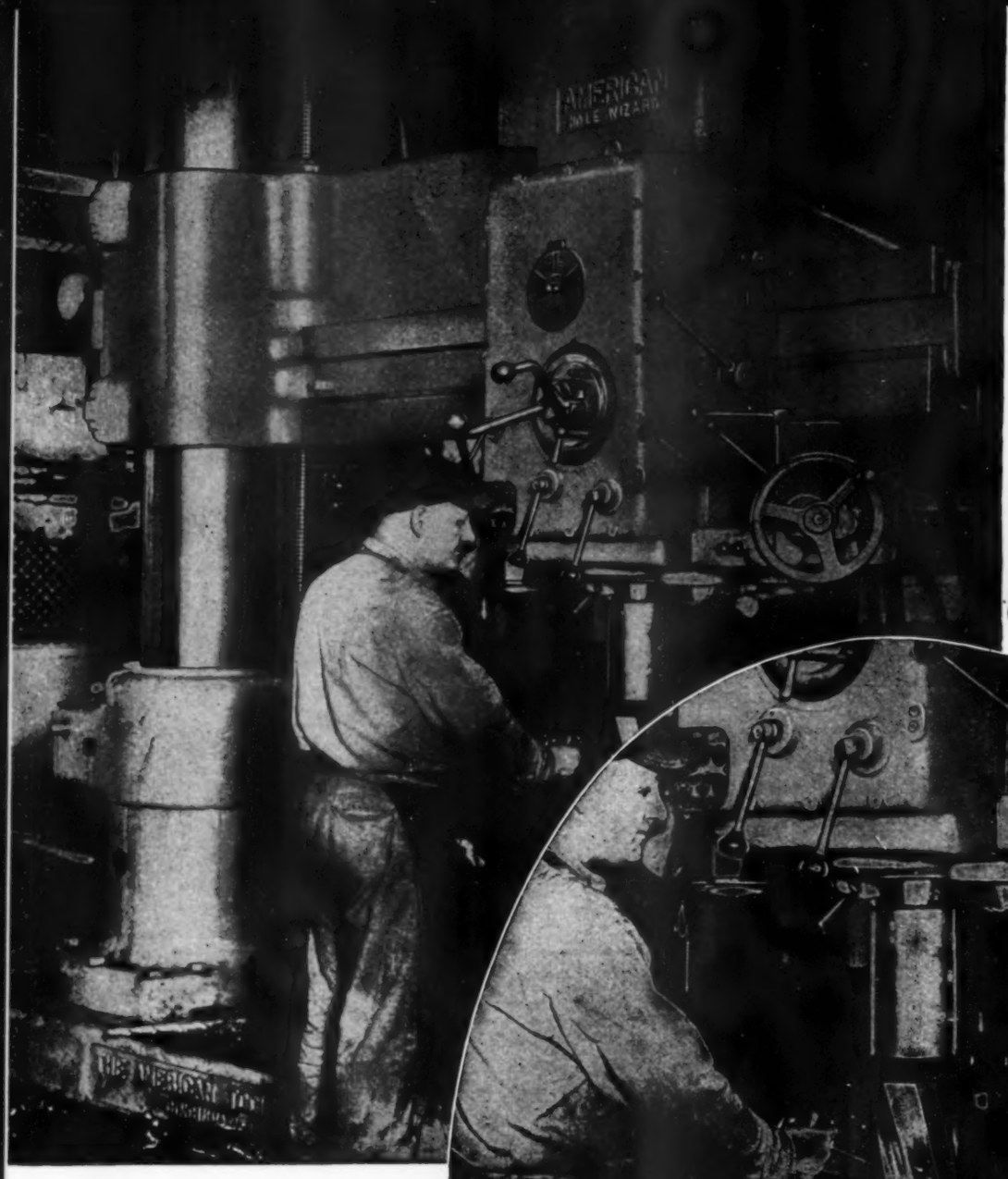
5° angle set on Tilting Wheel Head while grinding step counterbore using combination attachment. Close tolerances between steps easily maintained by graduated cross feed handwheels.

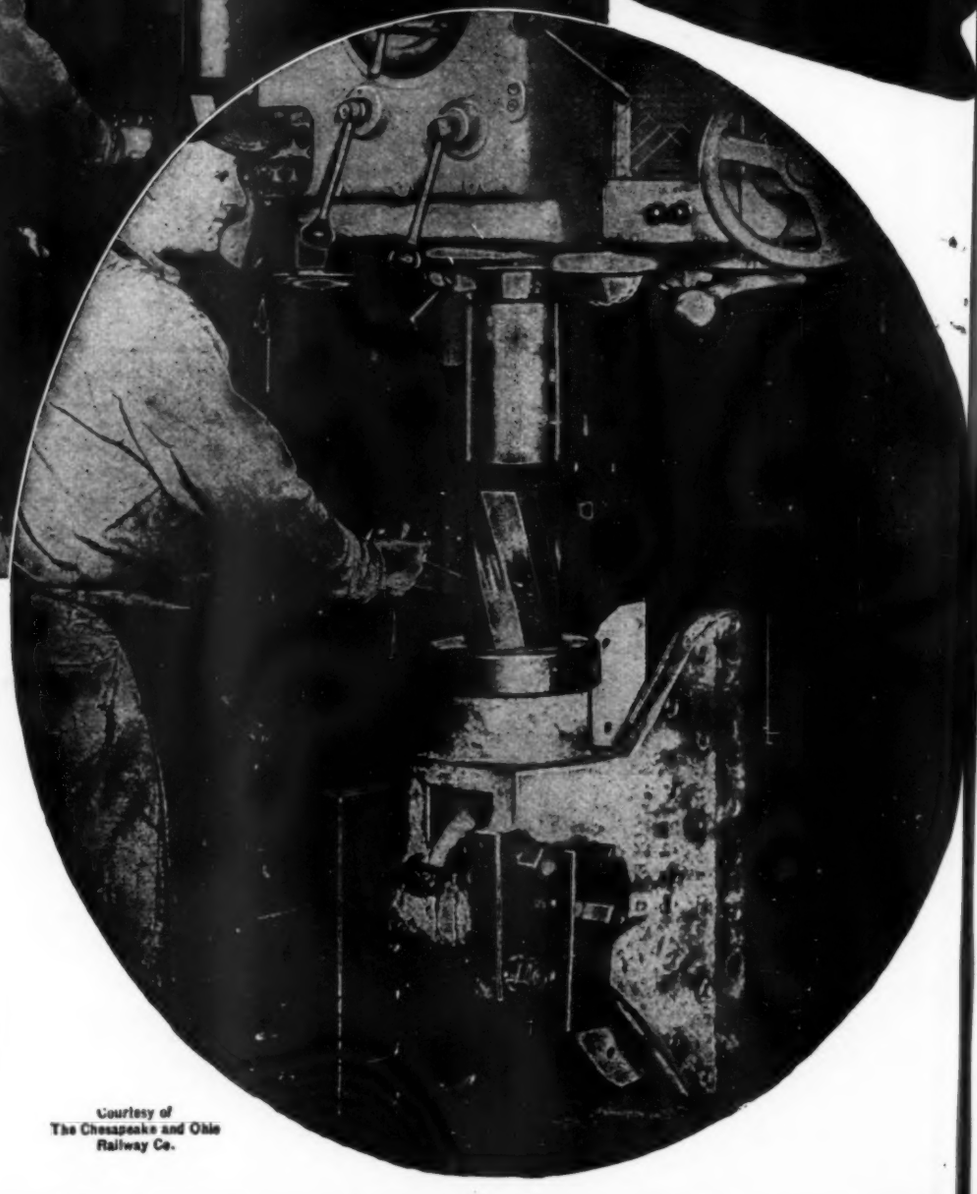


2° angle set on Tilting Wheel Head while grinding form tool. Tool is ground in single setup and wheel truing is minimized. Note the sharp corner which has been maintained on the tool.

NORTON GRINDERS
and Lappers

NORTON COMPANY, WORCESTER 6, MASS • New York • Chicago • Detroit • Cleveland • Hartford • Distributors in All Principal Cities





Taper reaming locomotive cross heads for piston rod fits.

Courtesy of
The Chesapeake and Ohio
Railway Co.

THE AMERICAN TOOL WORKS CO.

The Acid Test of SPINDLE CONSTRUCTION

Reaming cross heads for piston rod fits is about the toughest job you can find for a radial drill spindle.

This work must be done at slow speeds, without chatter and with a fine finish.

IT'S A TOUGH ONE BUT—

1 **The boring mill construction of the "American" Hole Wizard Spindle does the job. Its 100% anti-friction design with adjustment for wear insures frictionless operation and maintenance of original accuracy.**

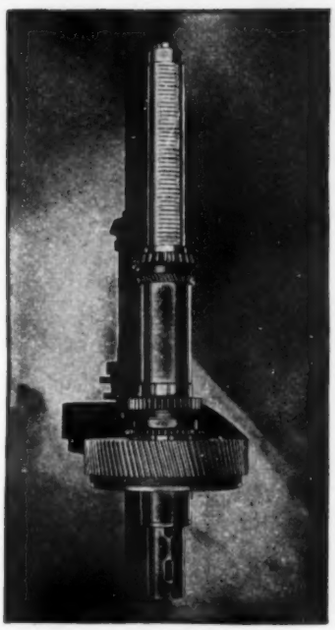
2 **The patented Double Lo-Hung Spindle Drive locates the large diameter driving gear at the bottom of the head close to the work, thus minimizing spindle torque.**

3 **The large diameter spindle, recently increased to add 37% to its rigidity, easily resists the enormous torsional effort imposed by this job.**

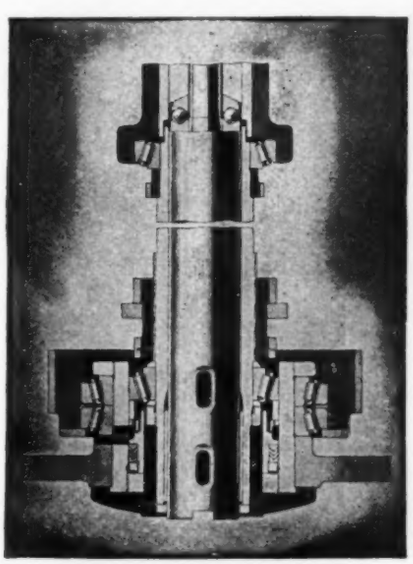
4 **Spindle shake is reduced to an absolute minimum by allowing only .00025" freedom between the ground nitrided spindle and the honed nitrided spindle sleeve. This is especially valuable on accurate boring operations.**

These four spindle characteristics are YOUR assurance that YOUR tough ones will be done easier, quicker and cheaper with an "American" Hole Wizard on the job.

Civilian goods and services must be produced in greater quantities and at lower costs. The "American" Hole Wizard Radial definitely is a contributor to this cause.



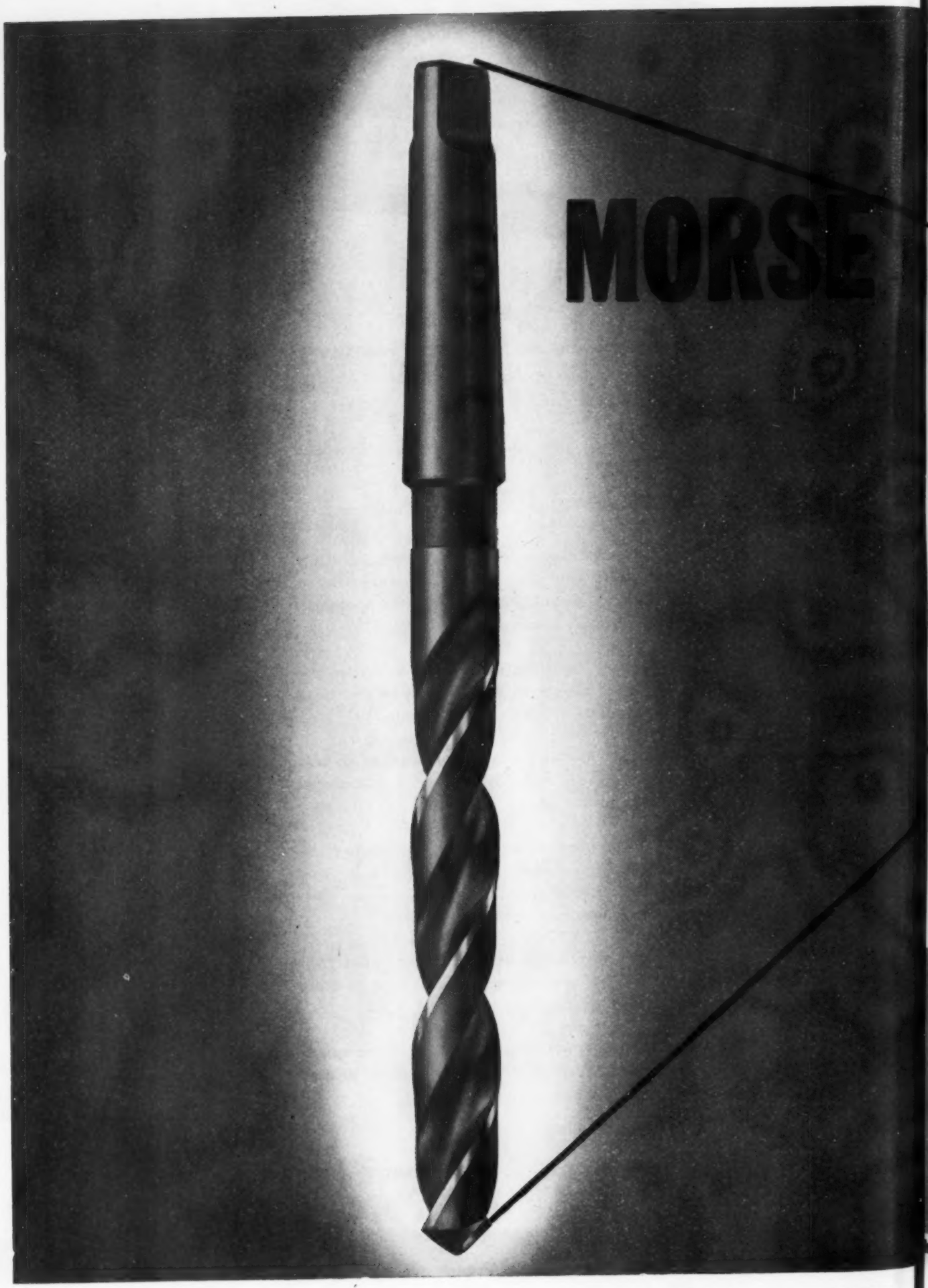
Patented Double Lo-Hung Spindle Drive.



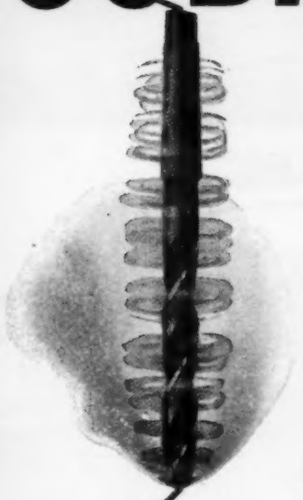
Patented Double Lo-Hung anti-friction spindle mounting.

BULLETIN 327 TELLS THE STORY . . . YOURS FOR THE ASKING

CO. *Lathes and Radial Drills* **Cincinnati, Ohio U.S.A.**


MORSE

COBALT DRILLS PERFORM



Where Standard High-Speed Steel Drills Fail!

ON THE *TOUGHEST* GOING . . . manganese, hard steels, castings, forgings, and other difficult to drill material . . . Morse *Cobalt* Drills out-perform standard high-speed drills.

What's more, Morse *Cobalt* Drills can be run about 25% *faster.* They hold their cutting edges far longer, too . . . and they have the rigidity and strength to buck severe strains, when used in a rigid drill press with positive drive that will stand extreme point-pressure.

NOW . . . whether you drill tough steel, brass, plastics, or aluminum, always bear in mind that there is one Morse Drill of the right specification, length, diameter and twist-cut to do *your* job *best, at lowest cost.* And bear in mind, too, that with all these factors, it always saves you money to leave the complete specification up to us . . . through your distributor of Morse Twist Drills, Reamers, Taps, Dies, Milling Cutters, End Mills.

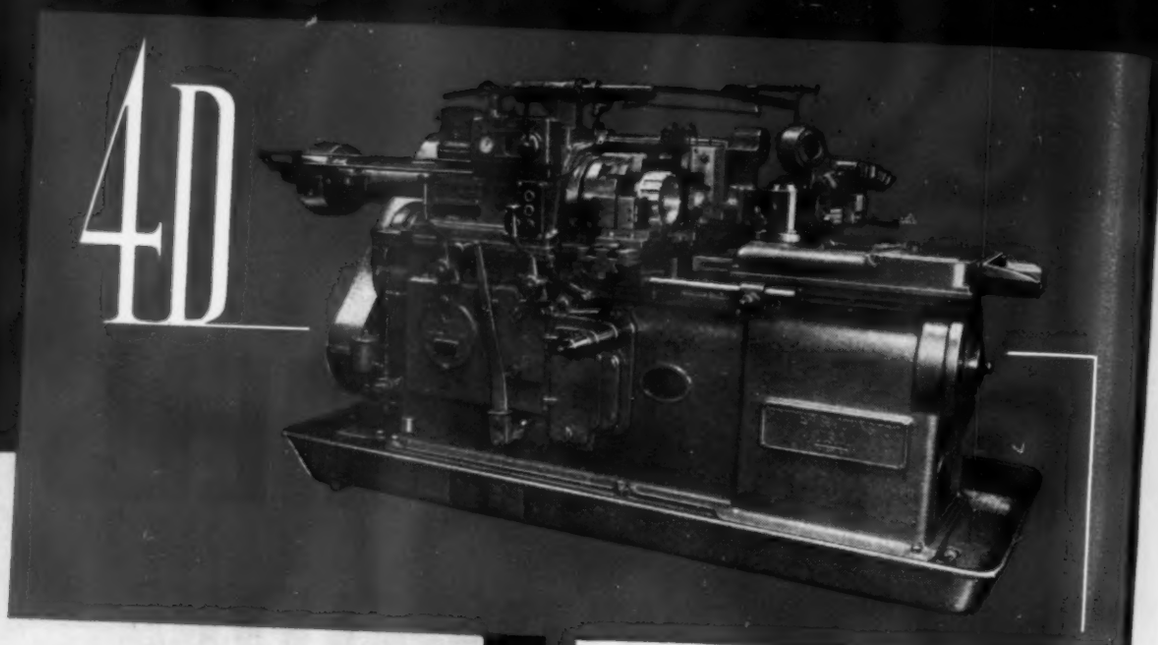
Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manu

MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASSACHUSETTS

A DIVISION OF VAN NORMAN COMPANY

York Store: 130 Lafayette St. • Detroit Store: 2952 East Grand Blvd. • Chicago Store: 570 West Randolph St. • San Francisco Store: 1180 Folsom St.



Machining 17 Fill Rings per Hour on a...

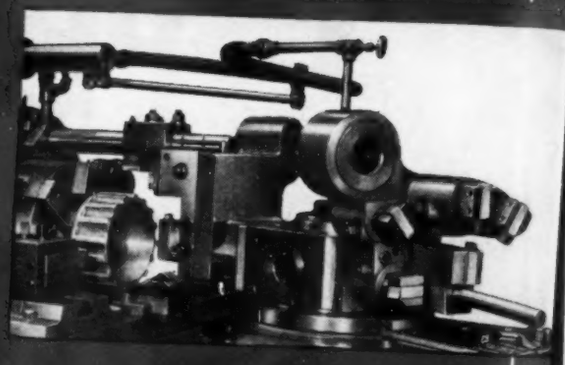
P&J 4D AUTOMATIC

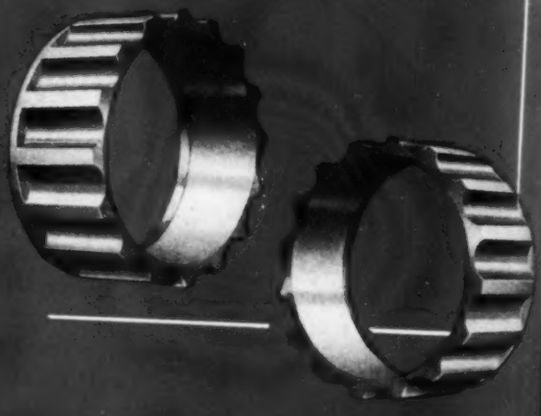
Although the P&J 4D Automatic Turret Lathe is ordinarily equipped with a 5-face turret, the job being machined here required tooling up for only 2 turret faces. This means that there is ample provision left for other tooling in the event that at a future time other subjects are to be machined. Tooled as shown, work is handled in an average time of 2.99 minutes per piece. One operator can readily handle several machines.

Versatility of tooling is an inherent characteristic of all P&J Automatic Turret Lathes and accounts for the outstanding production records being made by these machines on a wide range of work.

Send your drawings to P&J Methods Engineers and let them show you how you can cut your costs on duplicate parts production.

POTTER & JOHNSTON COMPANY
Pawtucket, R. I.
Subsidiary of
Pratt & Whitney
division Niles-Bement-Pond Company





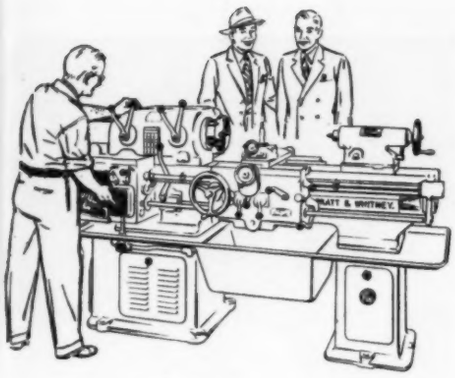
DETAILS OF JOB

Part: Fill Ring
Material: Aluminum Casting
Method and Operation:
Presenting chucking ring to spindle; grip under same with 3 chuck jaws.

Machine as follows:

1st T.F.: Rough bore hole; rough turn O.D.; straddle-face ends; chamfer where necessary.
2nd T.F.: Blank
3rd T.F.: Finish bore 6.285" dia. hole; finish turn O.D. (Vertical Slide Tool).
4th T.F.: Blank
5th T.F.: Blank

. . . and that's why he bought this particular Lathe!



His name is Bill. He has spent his whole life bossing a toolroom and chasing the elusive "tenth". He's the kind of man we like most to deal with, because he knows what's what in precision machine tools.

His first look at a P&W Model "C" Lathe registered "eye appeal" that any shop man likes. We never said a word as he looked it all over . . . we just motioned him toward the starting button. It was an education to watch him try out this lathe . . . feeling out the controls and speeds — later under light and heavy cuts. He trusted his finger tips, and they told him more than his eyes and ears.

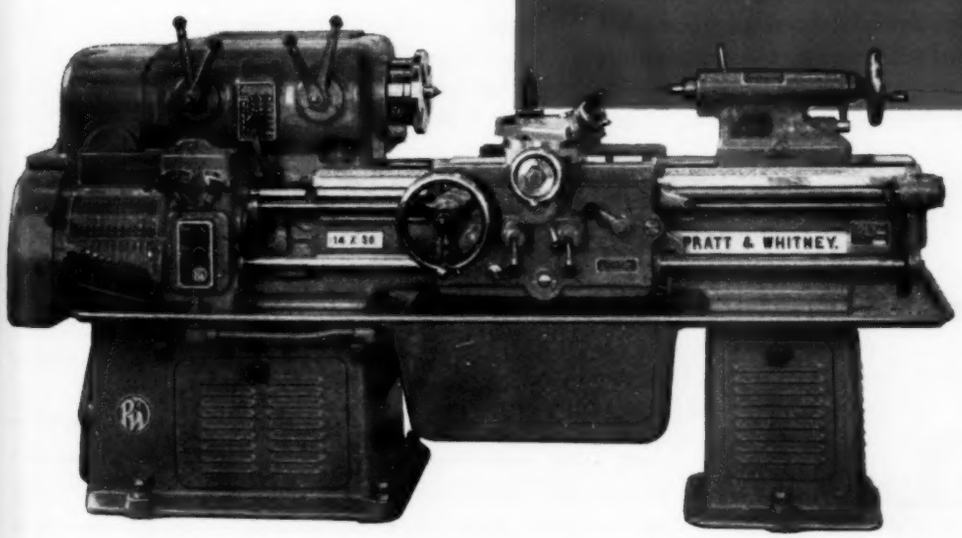
Bill told us afterwards "it had all the old tested qualities that my men like . . . but developed to a new high degree of smooth accurate power."

We believe Bill knows lathes far better than most men. His try-out was the most complete we've ever seen. His decision to revitalize his shop facilities with new Pratt & Whitney Model "C" Lathes means that his wide experience picked this as the best lathe.

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford 1, Connecticut

The standard by which all fine lathes are judged

Pratt & Whitney Model "C" Lathe



Literature describing this *high degree* P&W Lathe is yours for the asking.

Does INSPECTION

cost you money

OR

save you money?

Old-fashioned methods of dimensional inspection definitely increase your costs—because they find errors only *after* the scrap and rework are made. An inspection system should catch the errors *before they happen!*

Visible gaging—Dial Indicator Gaging — offers major advantages over old-fashioned *feel-your-way* methods. The Dial Indicator gives you the reading at a glance. Human error is minimized; the sense of sight is more dependable than the sense of feel. Moreover, if the workpiece is off-size, the Dial Indicator tells you exactly which way and exactly how much. This means greater salvage, less scrap.

This photograph shows an application of the Dial Indicator to the gaging of inside hole diameters. There are no blind spots for this gage; it tells you the exact dimension—in .0001"—*and every variation.* These gages are available in both portable and bench models—to inspect holes ranging from .122" to 12.665" in diameter.

We make both regular and custom-built gages to meet the needs of users in a hundred industries. For highly specialized needs, we also make Air Gages and Automatic Electronic Sorting Gages . . . Important applications of these two types of gages are shown on the opposite page.

COLOR FILMS AVAILABLE—LOANED ON REQUEST

(1) "The Dial Indicator" } on one
(2) "Dial Indicator Gages" } large reel

Showing fundamentals and uses

FEDERAL

FEDERAL PRODUCTS COPORATION

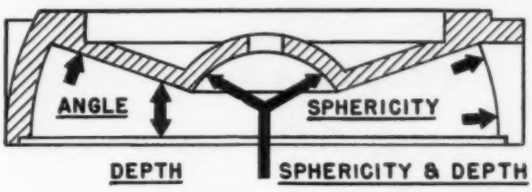
YOUR PROFIT DECISION IS *Visible** PRECISION

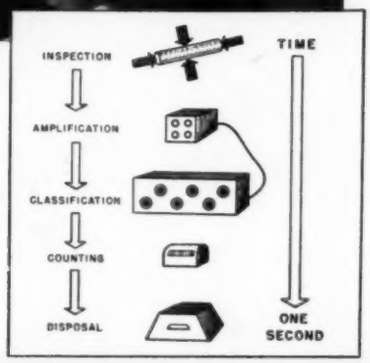
***The use of Dial Indicator Gages — visible precision — lowers inspection costs, raises production. Federal Products Corporation is America's largest maker of both regular and custom-built gages — mechanical, air, electronic — for the measurement of single and multiple dimensions.**

AIR GAGE INSPECTS
involved dimensions in liquid meter chamber

This Gage illustrates the exceptional possibilities of gaging involved dimensions simultaneously by air. It checks the internal side wall for sphericity and the conical section for angularity and depth. Simultaneously the concentricity of these three surfaces is checked relative to each other. The Dial Indicator checks the depth of the ball seat. Another Gage, used in conjunction, checks the sphericity of the ball seat when the two halves of the chamber are assembled. Such intricate gaging becomes simple with a Federal Air Gage.

Courtesy of Worthington-Gamon Meter Co. (subsidiary of Worthington Pump and Machinery Corp.)





ELECTRONIC GAGE
sorts pen barrels for length and diameter

This Electronic Sorting Gage segregates 3600 pen barrels per hour into eight size categories—for Esterbrook Pen Company of Camden, N. J.—*three times faster* than by previous methods. Barrels too short and too long are rejected first. Those O.K. for length are then sorted into four acceptable diameter groups each having spread of .002". Over and undersized diameters are rejected. Automatic counters keep tally of number of parts per category. Gage shuts off when count in any group reaches 1000.

Write for illustrated Bulletin **46** to receive detailed descriptions of the above gages. Let us help you with any problem of gaging and inspection. If you will send us blueprints of work to be measured, we will gladly recommend the proper gage. No obligation is involved.

FEDERAL PRODUCTS CORPORATION **1144 Eddy St., Providence 1, R. I.**
Represented in Canada by RUDEL MACHINERY COMPANY, LTD.

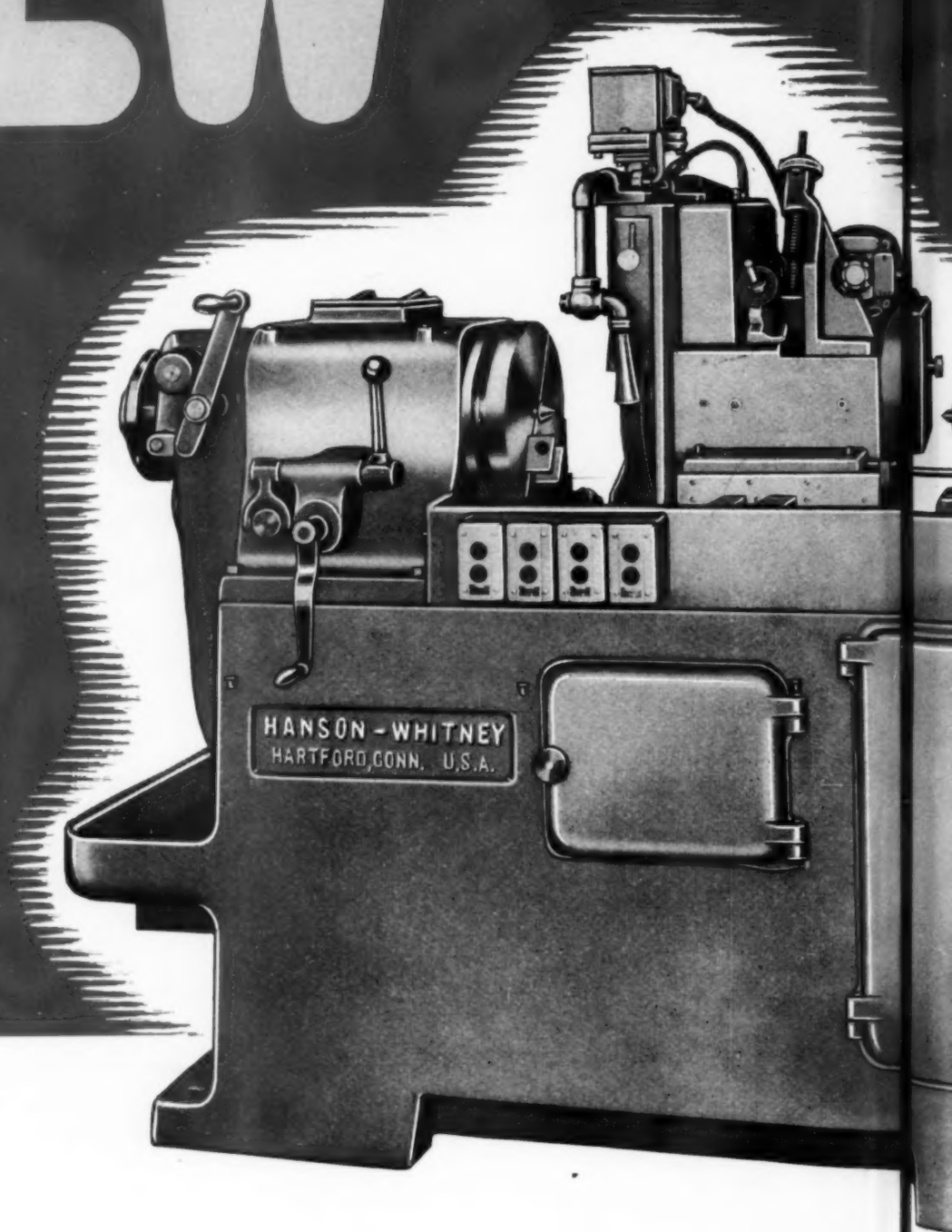
Semi-automatic

HANSON-WHITNEY THREAD GRINDING

NEW

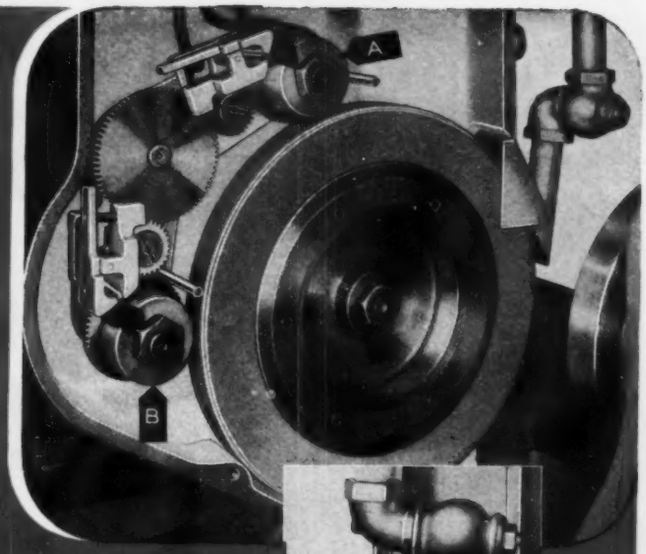
Featuring

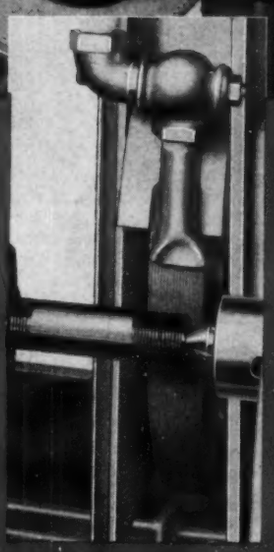
- MASTER ROLL
- CRUSHER ROLL
- MULTI-RIB GRINDING WHEEL
- AUTOMATIC . . . EXCEPT LOADING
- ACCURATE THREADS AT HIGH SPEED
- NO THREAD DISTORTION
- FAST WHEEL DRESSING
- MORE PIECES PER DRESSING



G MACHINE

This new development now provides industry with a high speed production machine for multi-rib grinding of external threads from the solid.



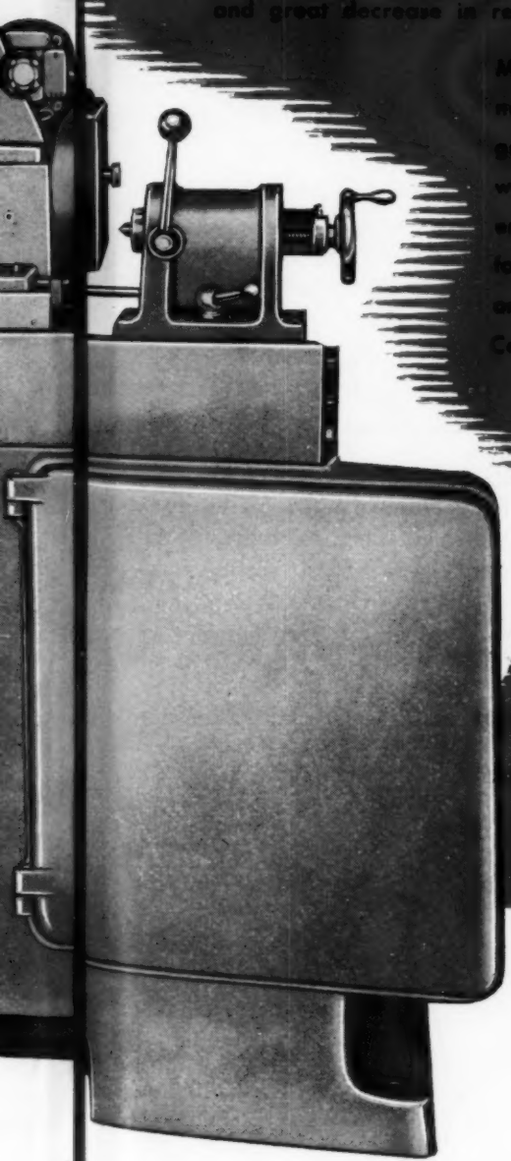


Hanson-Whitney design adds important features... a Master Roll (A) to maintain life of the Crusher Roll (B), which in turn crush-forms the Grinding Wheel to the required thread pattern... thread capacity to 2" lengths, produced in 1 1/4 revolutions of the work... accurate, properly mated threads, closer limits, size duplications... at highest speeds... and great decrease in rejects.

Master Roll principle prevents down-time... eliminates necessity of sending crusher roll away for re-grinding. Rocker arm places master roll in contact with wheel for dressing. Wheel then re-forms crusher roll. The cycle may be repeated many times... for better cutting surface... with more cutting points on the wheel... less heat generated in the work. Can't begin to tell the story here... so...

For details... send for NEW BULLETIN

HANSON-WHITNEY MACHINE CO., HARTFORD 2, CONN.
Division of Whitney-Hanson Industries, Inc.



Hanson Whitney

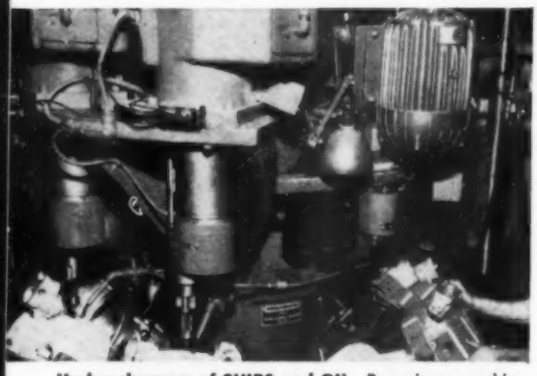
PIONEERS OF FINISHED TAPS

Compare the Maintenance Saving

IT'S A STOCK MOTOR
"MADE-TO-ORDER"
FOR THE TOUGHEST SERVICE

For DUSTY LOCATIONS In this woolen mill, even airborne lint is no problem. It can be cleared from the air grille of the fan cowl, or the cowl vent, with a whisk of a brush while the motor is running.

For CORROSIVE CONDITIONS Used for driving a chemical pump, this SEALEDPOWER motor convincingly demonstrates the high resistance of the sturdy cast iron frame to corrosion.



Under showers of CHIPS and OIL Powering a machine tool, this SEALEDPOWER motor proves its effective seal against chips, splashing oil or coolant, vapors, or dust.

FOR ANY APPLICATION WHERE
EXCESSIVE MAINTENANCE IS INDICATED
—specify SEALEDPOWER and SAVE

You'll Agree THERE'S NO OTHER MOTOR LIKE THE

C-W SEALEDPOWER

TOTALLY-ENCLOSED....FAN-COOLED MOTOR

"Time-out for clean-out" is the bugbear that boosts maintenance of most totally-enclosed, fan-cooled motors. But "time-out" is designed out of the C-W SEALEDPOWER Motor. Because there are no easily-clogged, hard-to-clean internal ventilating passages, you don't have to take it apart to clean it.

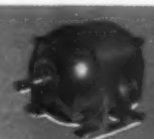
ONLY THE SEALEDPOWER MOTOR has exterior cooling, with the fan driven airstream blowing over the finned frame, carrying dust and fumes *outside* and *away*.

IT'S A PRODUCTION BOOSTER! You can install a SEALEDPOWER and forget it . . . it cleans itself. Even under extremely dirty conditions, the SEALEDPOWER keeps production going many times longer than "ventilating passage" motors without a shut-down for cleaning. Just figure the production time gained.

CONTINUOUS COOL-RUNNING EFFICIENCY The exclusive outside fin construction provides over 150% *more* cooling surface. And cool operation is continuous, year after year, because no blanket of dust can pile up to block escaping heat.

BEATS RUST AND CORROSION The frame of the SEALEDPOWER is rugged *cast iron,* for highest resistance to conditions of excessive moisture and corrosion. There is no steel to rust. Vital operating parts are sealed securely in a pocket of clean air.

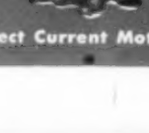
SEALEDPOWER is now available in new ratings . . . 3 to 40 hp . . . horizontal and vertical with NEMA "C" face, "B" or "D" flange mountings. Talk over your motor needs with a Crocker-Wheeler representative. Or, write for descriptive data on Crocker-Wheeler AC and DC motors and generators, and flexible couplings.



Protected-Type Motors

Sealedpower Motors

Wound Rotor Motors



Direct Current Motors

Generators

Flexible Couplings

# of 80% and more!

150% MORE COOLING SURFACE
is provided by the radiating fins, exclusive with the C-W SEALEDPOWER. Here, fluttering streamers trace the fan-driven airstream that blows dust and fumes outside and away.

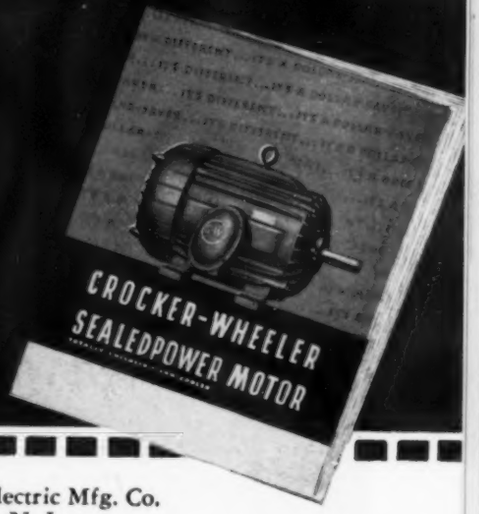
CROCKER WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE 3, N. J.

A Division of The Joshua Hendy Corporation

Branch Offices:
Boston, Chicago, Cincinnati, Cleveland, Los Angeles, New York, Philadelphia, San Francisco, Pittsburgh, Washington, D. C. — Representatives in principal cities.

QUALITY MOTORS AND GENERATORS SINCE 1888



Before You Buy ANY totally-enclosed motor, be sure to read why SEALEDPOWER will prove a "maintenance miser" for you. This new booklet, "It's Different—it's a Dollar-saver," is packed with facts no savings-minded motor user can afford to overlook. Write for it.

Crocker-Wheeler Electric Mfg. Co.
Ampere 3, N. J.

Send the SEALEDPOWER Motor Booklet, *"It's Different—it's a Dollar-Saver"*.

Name AN848

Title or Function .....

Company .....

Address .....

TO OBTAIN THE LONGEST WEARING GAGE
Request a NORBIDE Gage

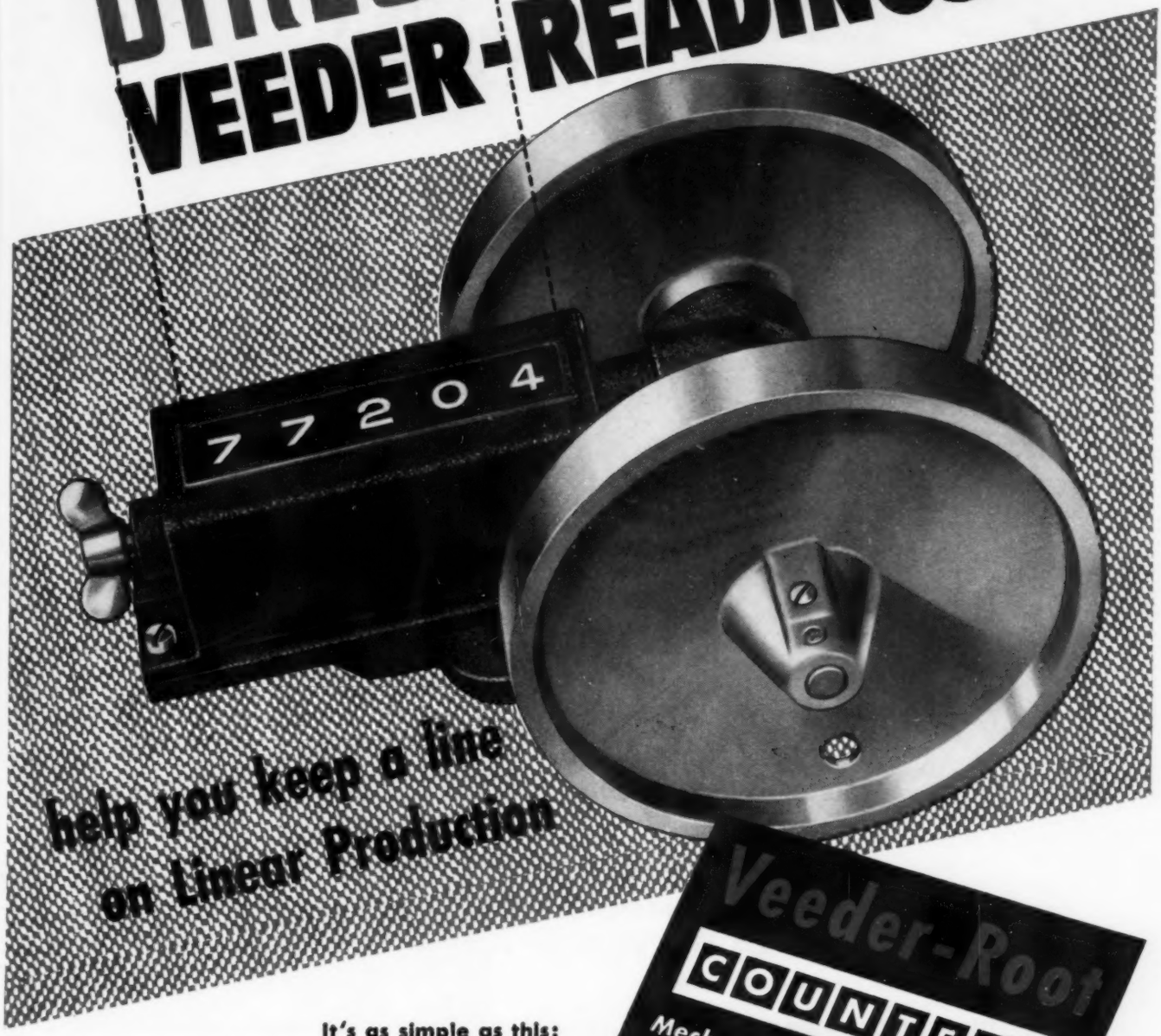
then *DOUBLE* gage life again by making it *REVERSIBLE.*

NORBIDE plug gages, along with many other types of NORBIDE gages, have long been known to gage users for their exceptionally long-wearing qualities. NORBIDE gages are made of Norton Boron Carbide which is the hardest material made by man. Gage life has often been increased up to one hundred times by the use of NORBIDE members in the gages.

Some gage suppliers are further doubling plug gage life by producing reversible gages. As one end of either the "go" or "no go" member becomes worn, it may be removed from the handle and reversed with the unworn end thus being made available for further long gage life. Your regular gage supplier should be able to provide NORBIDE gages or, *for further information, we invite your inquiries.*

NORTON COMPANY, WORCESTER 6, MASS.

DIRECT VEEDER-READINGS



help you keep a line on Linear Production

Veeder-Root COUNTERS

Mechanical, electrical, manual for every machine and product and process

It's as simple as this: Textiles and other materials pass under the smooth-surfaced twin wheels. And the worm-drive gears inside the counter cause the 5 figures to indicate directly in yards, feet, meters, or other units. The wheels are one foot in circumference . . . and other types of wheels, even grooved ones, can be had, for other purposes and materials.

This Reset Worm-Driven Counter is one of scores . . . yes, *scores* . . . of Standard Veeder-Root Counters which count in terms of linear units, pieces, revolutions, strokes, operations, trips, volumes, light-flashes, hand-movements, or anything else you want to count. And if a *Standard* Veeder-Root Counter won't meet your needs, then "Counting House" engineers can design a special counter that *will.* You can count on that . . . *write.*

VEEDER-ROOT INC., HARTFORD 2, CONN.

In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3
In England: Veeder-Root Ltd., Dickinson Works, 20 Purley Way, Croydon, Surrey

Remington Rand

MACHINES FOR MANAGEMENT

WATCHMAKER PRECISION characterizes every phase of Remington Rand's activities . . . PRECISION in advanced engineering . . . PRECISION in manufacturing hundreds of thousands of intricate assemblies to serve the world's business.

they PUT IT ON THE BLANCHARD

THE JOB: GRINDING BOTH SIDES OF PRINT WHEELS — TO LIMITS ±.00025". Material is No. 1010 Steel — 2.660" diameter x .100" final thickness. Stock removal per side is .009" to .013".

THE METHOD: *Remington Rand Engineers chose a No. 18 Blanchard Surface Grinder* . . . 113 print wheels are simply and quickly placed on the 36" magnetic chuck. . . .

THE RESULT: *which of course governed the choice of the most suitable machine* . . . two chuckloads or 226 accurately sized pieces (452 surfaces) per hour. Difficult grinding jobs are made simple with Blanchard Grinders.

Whether your flat surface grinding job is simple or seemingly difficult, Blanchard Engineers will gladly assist you in arriving at the most profitable solution. Avail yourself of this free, non-obligatory service.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

CAN YOU COMPETE AGAINST

THREAD PRODUCTION LIKE . . *this*

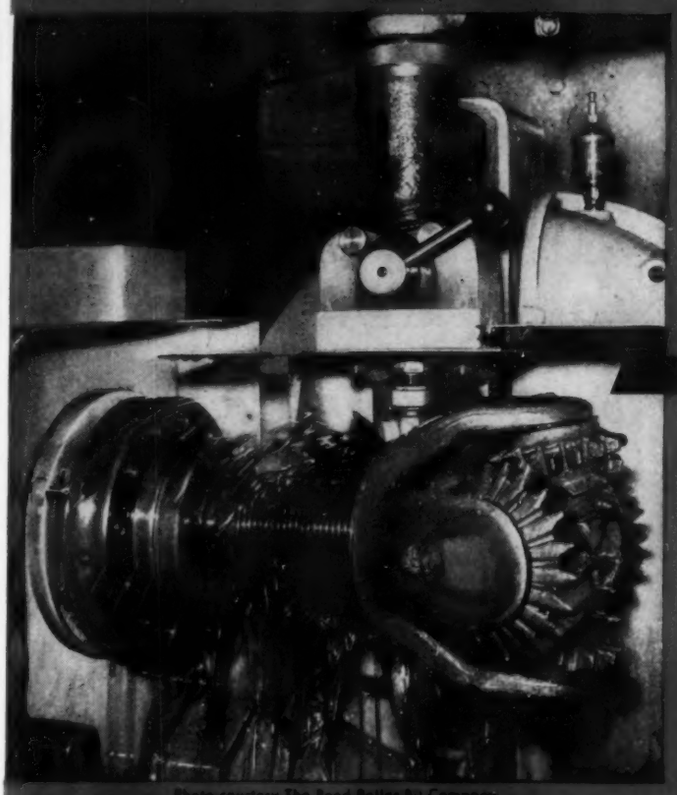
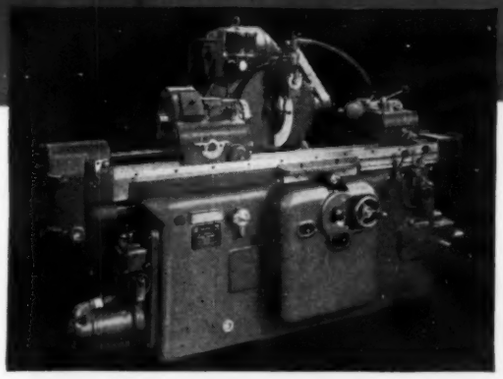


Photo courtesy The Reed Roller Bit Company

This 4 inch diameter, 4 pitch A.P.I. special form tapered thread, 5½ inches long, is ground from solid SAE-4815 Electric Weld forging in 4½ minutes!



This outstanding production on a really tough threading job is obtained on a Jones & Lamson 12x45 Automatic Thread Grinder. *The three-rib wheel removes approximately 1 pound of metal, in one pass.*

Jones & Lamson Automatic Thread Grinders guarantee you the highest production of fine quality threads in even the toughest, hardest materials. They can reduce not only your direct threading costs, but can reduce costs all along the line.

- They reduce handling costs
- They eliminate costly rethreading after heat treatment
- They eliminate expensive retooling when specifications change
- They reduce the cost of gage maintenance

Let a Jones & Lamson engineer study your threading operations. He will be able to make recommendations that will improve your profit picture. He has for others.

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U. S. A.

Manufacturer of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Double-End Milling and Centering Machines · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers · Ground Thread Flat Rolling Dies

Jones & Lamson
AUTOMATIC THREAD GRINDERS

"Run-out" reduced Timken®

New Timken "Double-Zero" bearing opens the way to new standards of accuracy in high precision applications

The most accurate Timken bearing on the market until now has been the "*Zero*" bearing, having a maximum run-out tolerance of only 150 millionths of an inch, the average run-out being well under this figure.

Now The Timken Roller Bearing Company is offering industry a new bearing *twice as accurate* as the "Zero" *. . . twice as accurate as the most accurate Timken bearing previously made!*

It's the new Timken "*Double-Zero*" bearing. Maximum run-out, 75 millionths of an inch. Average run-out well under this.

Here's an opportunity for new standards of precision in machine tools, scientific instruments . . . wherever extreme accuracy is essential.

Based on 49 Years' Experience

For the past 49 years, Timken has continually improved the efficiency and accuracy of Timken tapered roller bearings. Hardly a year has gone by without some notable improvement in Timken bearing performance. The development of the "Double-Zero" bearing is based on this 49 years' experience in manufacturing progress.

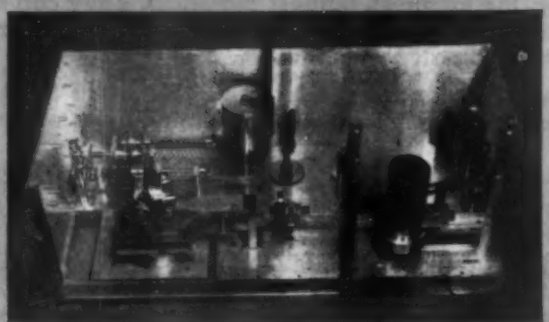
More Accurate Machinery Built

Producing bearings accurate to a few millionths of an inch calls for the use of machines of equal accuracy. Many of the machine tools producing "Double-Zero" bearings were specially developed and built by Timken engineers to provide the necessary precision. These new machines, combined with painstaking manufacturing methods, make possible the extremely close tolerances in the "Double-Zero" bearing.

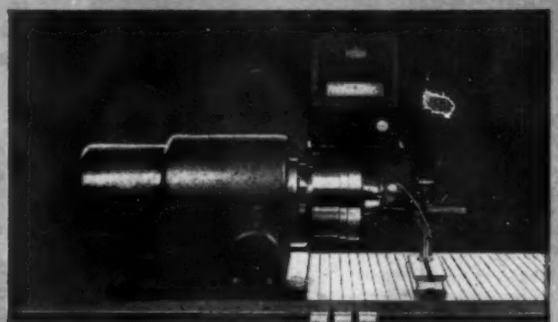
New Measuring Instruments Developed

From time to time, in the development of better and better bearings, Timken has been faced with the problem of first developing accurate measuring instruments

THESE INSTRUMENTS MADE THE DOUBLE-ZERO BEARING POSSIBLE



1. THE PROFILOGRAPH, developed by Timken in 1928 and steadily improved since then, determines surface irregularities to within one millionth of an inch. Equipped with this measuring stick, Timken engineers have developed new finishing methods and machines to produce the amazingly smooth surfaces of Timken bearing rolls and races.



2. THE CONCENTROMETER is the most recent of Timken research facilities. Measuring bearing run-out to less than 5 millionths of an inch, it is used to check circular parts for concentricity of inside and outside diameters, and squareness of face and shoulders. The Concentrometer was developed entirely within the Timken research organization.

by half in new bearing!

for new standards of bearing precision. Two of these instruments, perfected by Timken, played an outstanding part in making the new Timken "Double-Zero" bearing possible. They are the Profilograph, which measures surface smoothness in micro-inches, and the Concentrometer, which gauges run-out within 5 millionths of an inch.

Timken Steel Plays Important Part

Working to unprecedented tolerances puts added importance on the quality and heat treatment of the steel which goes into Timken bearings. Timken makes its own steel. Hardenability, grain structure, and chemical composition are rigidly controlled in Timken's own modern steel mill to provide the combination of qualities without which super-precision manufacturing would be impossible. Correct heat treatment is assured by the know-how resulting from our many years of metallurgical research and practical experience.

Advantages to be Widespread

Wherever high precision is a factor, the new Timken "Double-Zero" bearing opens the way for improved product performance throughout industry. In machine tools, for example, the "Double-Zero" bearing will permit working to much closer tolerances than are now possible. In scientific instruments, the new Timken bearing will insure a new degree of precision that will raise the limits of accuracy in laboratories everywhere.

Although the "Double-Zero" bearing is now limited in supply, manufacturing facilities are being increased as rapidly as possible. The "Double-Zero" bearing is the latest example of Timken leadership in serving the bearing needs of all industry . . . one more reason why it pays to look for the trade-mark "Timken" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

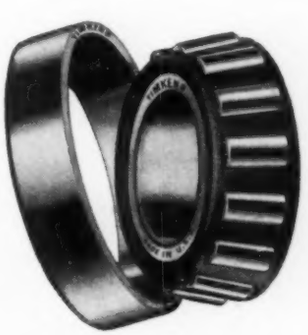
This symbol on a product means its bearings are the best.

A PRECISION TIMKEN BEARING FOR EVERY REQUIREMENT			
CLASS	**"00" (DOUBLE-ZERO)**	**"0" (ZERO)**	**"3" (THREE)**
Run-out	.000075"	.000150"	.000300"
Types available	Standard Single Row	Standard Single Row	All types
Size range	Up to 10" O.D.	Up to 12" O.D.	Up to 12" O.D.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

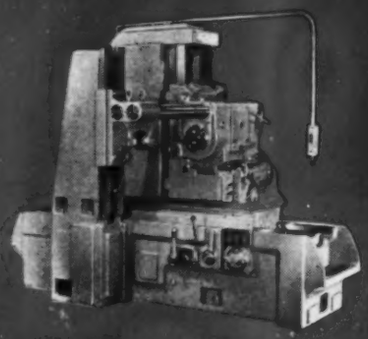
TAPERED ROLLER BEARINGS



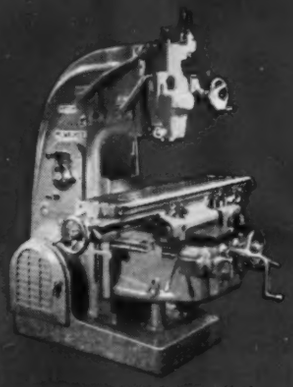
NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ←◫→ LOADS OR ANY COMBINATION

When selecting any machine tools **Choose From**

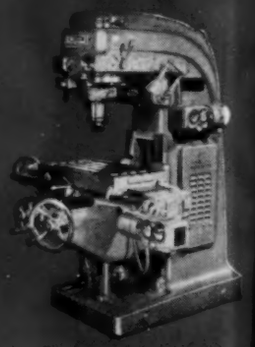
Model 4K Vertical — The largest of the famous "K" machines — also available in Plain and Universal styles, with Automatic Cycle Control on Plain and Verticals.



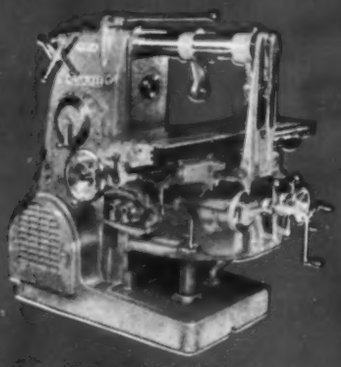
Model CSM Simplex — Massive new concept in bed-type milling machines . . . wide working ranges and horsepower capacities for best use of all cutters.



Model 2H Vertical Automatic Cycle — A very popular size machine — also available in Plain Automatic Cycle and in Plain, Universal and Vertical styles.

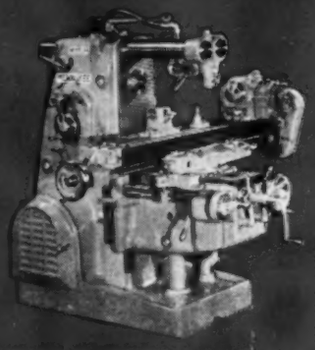


Model 2D Rotary Head Milling Machine — Extremely versatile and cost-reducing — especially suited to all kinds of precision tool, die, and production work.

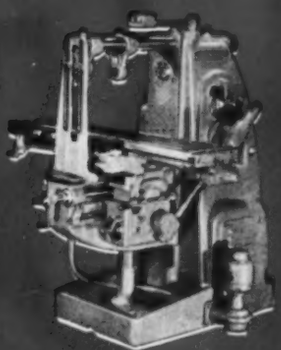


Model 3K Plain — The popular medium size in the famous "K" line — available in Plain and Vertical Automatic Cycle and in Universal and Vertical styles.

Model 20 CSM Plain Automatic Cycle — Also available in Vertical Automatic Cycle and Plain, Universal and Vertical styles. A big No. 2 machine.

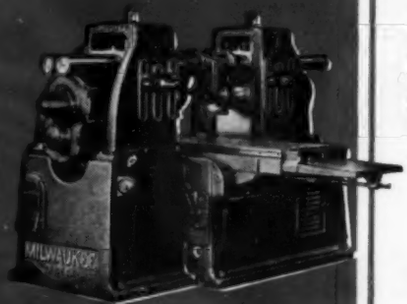


Model 2H Universal — the most popular size machine incorporating every precision refinement for fast, low-cost production as well as tool room purposes.



Model 2E Plain — Simplified design in size ideal for most shop purposes. Gives real economy in small part production — best dollar-for-dollar investment.

Model M-24 Simplex — High-speed, light class, production type machine — available with either 18", 24" or 30" longitudinal table travel. Simplex models only.



Model 1800 Duplex — High-speed, medium size, production type machine — also available in Simplex models. Choice of 24", 36" and 54" longitudinal table feed.

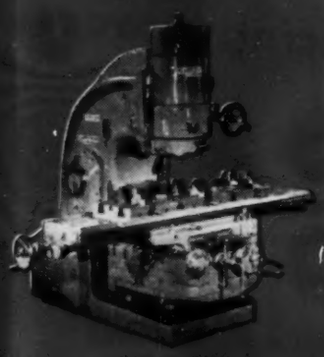
WHAT ARE YOUR NEEDS?

The Kearney & Trecker line of Milling Machines and Precision Boring Machines offers you literally *hundreds* of different working combinations. You can be certain that your specific job requirements can be accommodated, no matter whether they involve:

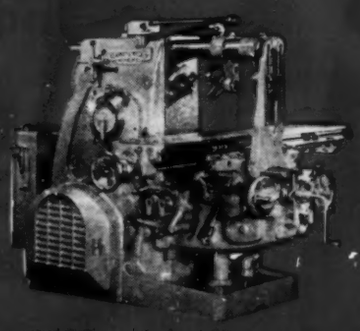
1. **Size or Type of Machine**
2. **Machine Working Ranges**
3. **Horsepower Capacities**
4. **Dual Spindle Speed Ranges**
5. **Automatic Cycle Table Control**
6. **Built-in Chucking Type Tables**
7. **Broad Feed and Speed Ranges**

THE KEARNEY & TRECKER LINE IS COMPLETE!

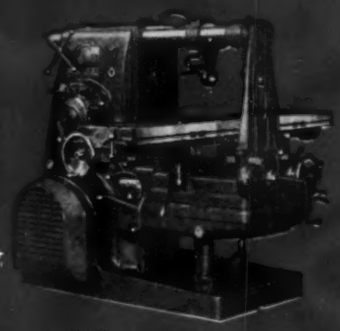
the First Choice Line!



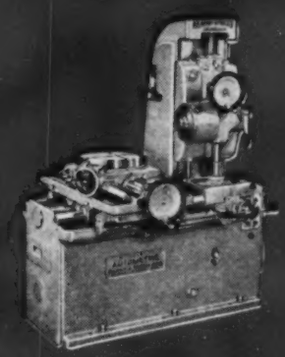
Knee type milling machine with Built-in Chucking Type Table — available in Nos. 2, 3, 4 and 5 sizes — Reduces set-up time up to 50% — saves fixture costs.



Duo-power milling machines provide two different spindle speed ranges in one machine, offering a wide range to accommodate the many cutting tool materials.



Model 5H Plain — The largest of the "H" line. — also available in Universal and Vertical styles and in Plain and Vertical styles with Automatic Cycle Control.



Model 2B Autometric Precision Boring Machine — for economy and precision. Built-in Rotary table handles work on several sides of workpiece with one set-up.

Kearney & Trecker Machine Tools Increase Your Production, Improve Your Precision, Reduce Your Costs

YOU'RE LOOKING at but 15 machines from the world-famous line of Kearney & Trecker milling machines and precision boring machines. Actually, this great line offers you over 250 different sizes, types, working ranges and horsepower capacities from which to select the exact machine you need.

If your problem involves milling or precision boring—there's a Kearney & Trecker machine to solve it. Model K machines are general all-purpose units; Model H machines are intermediate types. The CSMs are powerful knee types that use both H.S.S. and carbide cutters to maximum advantage. For high speed production, there are standard manufacturing types and standard knee types with single lever Automatic Cycle Table control. For unusual work-holding problems there are 36 machines with the new Built-in Chucking Type Table.

What's more, you'll find a wide choice of big machines with a variety of working ranges and horsepower capacities in the new CSM Simplex and Duplex bed types. For specialized toolroom or shop applications, there's the Model 2D Rotary Head milling machine and the Autometric Precision Boring line.

Kearney & Trecker offers a Customer Engineering Service where you can use the help of 50 years' experience in precision and production machine tool design and manufacture.

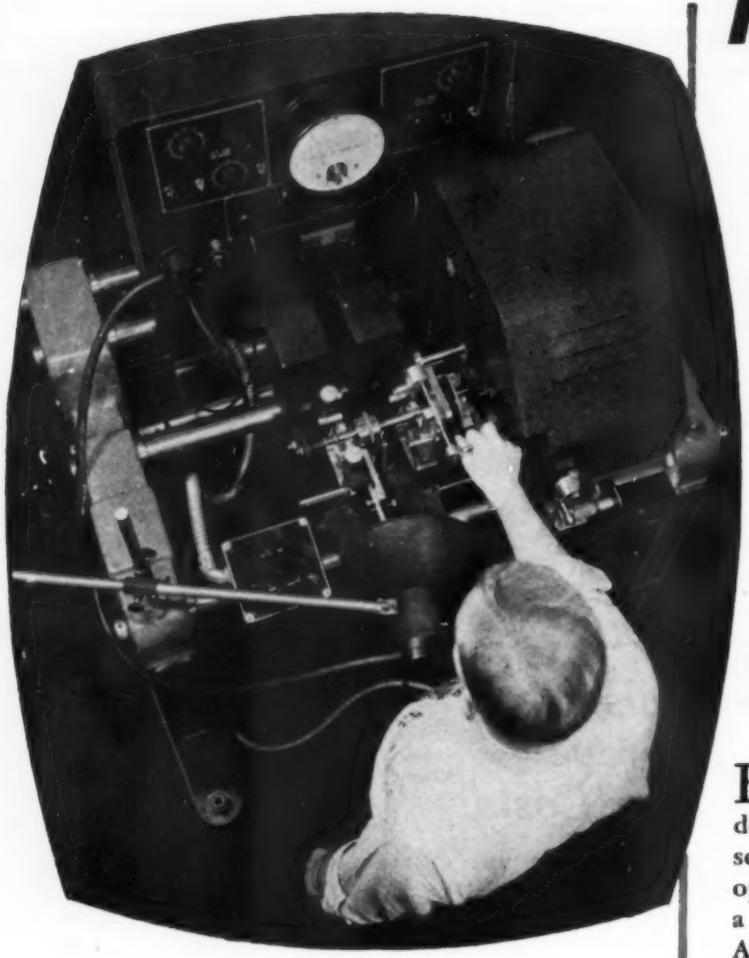
Write today for complete information on any one or all machines—or contact your nearest Kearney & Trecker dealer or branch office. No obligation. Kearney & Trecker Corporation, Milwaukee 14, Wisconsin, U. S. A.

Model 3C Autometric Precision Boring Machine — Large size vertical type machine — incorporates every refinement needed for 3-dimensional accuracy.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

1 MACHINE handles all 3 STEPS

of the complete balancing process!



1 *Locates and measures the unbalance*

2 *Corrects the unbalance*

3 *Inspects for over-all accuracy*

at the rate of 100 PIECES PER HOUR!

Balancing these fans for vacuum sweepers is now done completely on *one* machine. It takes only a few seconds to locate and measure the unbalance. Then, the operator turns the piece to the proper angle and turns a hand-wheel to correspond with the meter reading. At the press of a button, a fly-cutter removes the exact amount of metal to bring the part into balance. The part may be rechecked if desired.

The inclusion of correction equipment indicates the modern trend in balancing with Gisholt DYNETRIC Balancers. It saves handling—only one loading is required to complete all three steps.

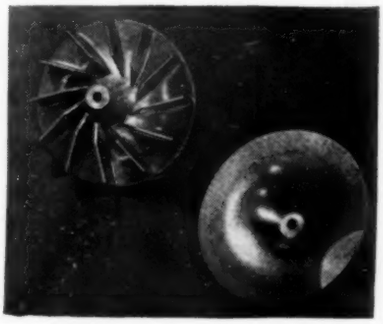
Those who are concerned with balancing of rotating parts have learned that it's wise to specify Gisholt.

DYNETRIC BALANCERS — GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION
"DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface finishing, and balancing of round and partly round parts. Your problems are welcomed here.



Showing front and back of fan with metal removed to correct unbalance. The entire balancing operation required an average of less than 45 seconds per piece.

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SUPERFINISHERS • SPECIAL MACHINES

"Certified" Service

AN ADDED REASON FOR INVESTING IN ALLIS-CHALMERS MOTORS!

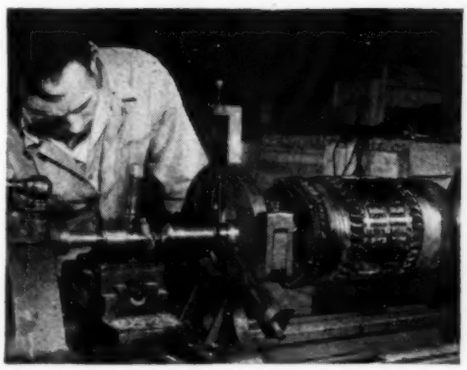
IT MEANS: 1) *Better, Faster Service.* Independent local repair shops are now being selected and authorized to service and repair Allis-Chalmers Motors, Transformers, Controls, Pumps — and "Certify" them as to workmanship.

2) *Finest Parts and Workmanship.* Shops use genuine Allis-Chalmers repair parts — or parts of equal quality; and are given complete service information, including factory procedure and drawings where necessary.

3) *Friendly Service.* Every Allis-Chalmers "Certified" Service Shop has been selected on the basis of its reputation in its community. It's the kind of company you *like* to do business with!

How can you get this service? For the present most "Certified" Service Shops are located in the larger U. S. industrial areas . . . but they're expanding rapidly. Call your nearby A-C District Office or Authorized Dealer for closest recommended shop. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

FINER, FASTER, FRIENDLIER SERVICE FOR INDUSTRY!



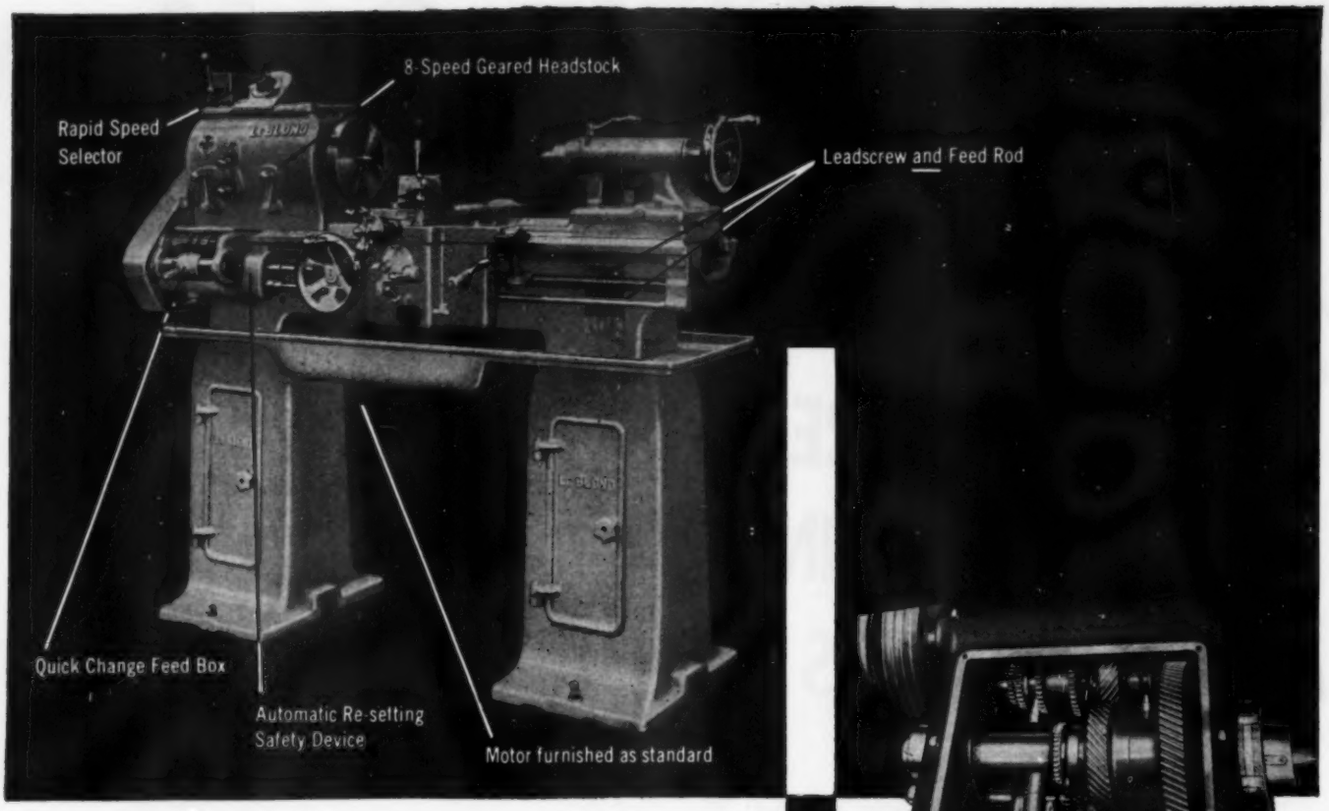
The A-C Supply Company of Cuyahoga Falls, Authorized Allis-Chalmers Dealer and newly-appointed "Certified" Service Shop, is staffed and equipped to give prompt, efficient, top-quality repair and service aid to customers in the greater Akron industrial area. Typical of the kind of "Certified" Service organizations being selected throughout U.S.

MANY SIZES, RATINGS OF ALLIS-CHALMERS STANDARD SQUIRREL-CAGE MOTORS ARE NOW AVAILABLE FROM STOCK. CHECK YOUR AUTHORIZED A-C DEALER, OR DISTRICT OFFICE FOR DETAILS.

A 2506

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products



more for your money with Le Blond Regals

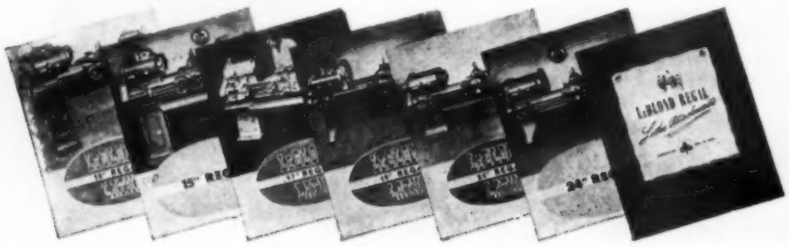
6 SWING SIZES — 13" TO 24"

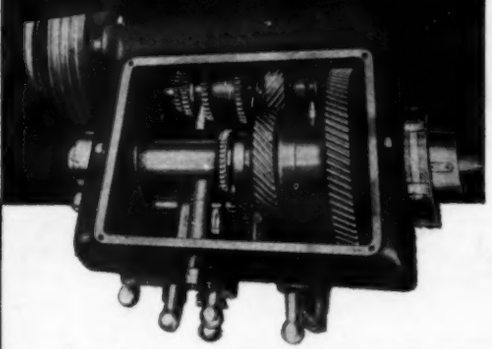
You definitely get your money's worth and then some, when you buy one of the six LeBlond Regals in 13", 15", 17", 19", 21", or 24" sizes. They're light pattern engine lathes with plenty of stamina and precision. Built in the same plant with LeBlond heavy duty lathes. All six equipped with both leadscrew and feed rod which assures long-life accuracy of the leadscrew. Electric brake with apron control, standard on 21" and 24" sizes, is available as extra equipment on all other models. Standard tapered spindle nose now furnished on all Regals.

Low initial cost plus low operating costs prove there's no better lathe value than Regals.

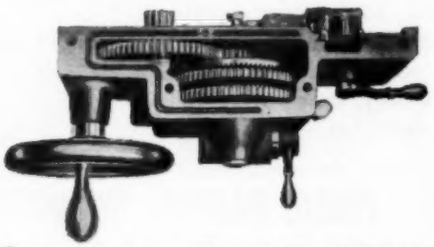
send for Regal bulletins today.

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES





1. 8-Speed Geared Headstock with simple lever control of speeds and feeds. All Regals now furnished with standard tapered spindle nose at no extra charge.



2. One-piece Apron with positive jaw feed clutch Single lever controls both length and cross feed; safety interlock prevents double engagement.

3. Inverted Vee-type Bed is built exceptionally heavy, provides rigid base for carriage and tailstock travel, assures long life accuracy.

LeBLOND

the *Cone Reporter* makes note that—

Conomatic Progress Reporter

Buffalo Niagara Electric Corp. will soon have the most powerful transformer ever built in this country. It steps up from 13,200 volts to 115,000 volts and can handle 150,000 horsepower.

Progress with Conomatics

A ten-pound plastic molding recently made by General Electric Plastic Div. is said to be the largest ever produced.

Conomatics for *Progress*

Linde Air Products Co. is now supplying liquid nitrogen capable of reducing temperature to –320°F.

Progress with Conomatics

Patent 2,441,594 has been granted for a method of separating iron from low grade ore. The iron patches are magnetized and then separated from the crushed ore by being pulled over a magnet.

Conomatics for *Progress*

A fully equipped Diesel research laboratory has been opened at Oklahoma Agricultural and Mechanical College.

A new Conomatic bar machine now provides simple dial control for change of working stroke travel of all slides. The machine retains all the advantages of Cone's exclusive, powerful, cam drive.

Progress with Conomatics

The new GE electric meter uses magnetic suspension for the rotor shaft instead of bearings.

Conomatics for *Progress*

The factory manager at Bata Works, Czechoslovakia, has an office that moves up and down in the building like an elevator.

Progress with Conomatics

Foote Mineral Co. of Philadelphia has begun the commercial production of zirconium.

Conomatics for *Progress*

Eaton Mfg. Co. has developed an automatic electric shift for its two-speed truck axles.

Kaiser-Frazer Corp. is preparing to make automobile doors of die-cast aluminum.

Progress with Conomatics

Battelle Memorial Institute has succeeded in welding aluminum slabs up to two inches thick.

Conomatics for *Progress*

Since hydraulic equipment is sometimes needed where electricity is not available, Hydro-Power, Inc., of Springfield, Ohio, is making a power unit driven by a gasoline engine.

Progress with Conomatics

Reeves Instrument Corp. is making an electronic computor capable of solving differential equations that is small enough to go in the average engineer's office.

Conomatics for *Progress*

Insulation can easily be stripped from wire by dipping it in a liquid made by Aircraft Marine Products, Inc., of Harrisburg, Pa.

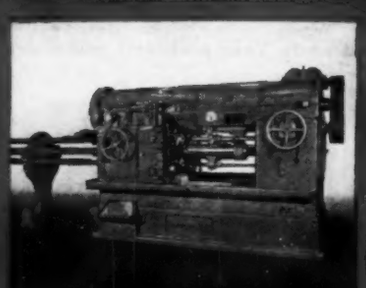
Progress with Conomatics

Libbey-Owens-Ford Glass Co. is making sound and heat insulating partitions of sealed double glass.

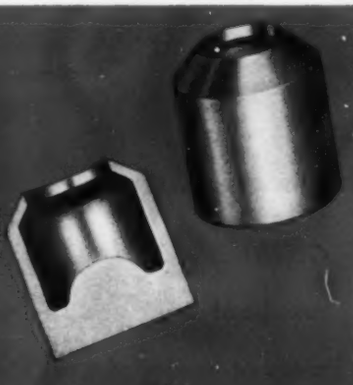
Conomatics for *Progress*

According to the Pittsburgh Bureau of Smoke Prevention the city has had 50% less smoke and 39% more sunshine during the last year.

ADAPTABILITY
and DEPENDABLE PERFORMANCE
Conomatics give BOTH



The sample shown illustrates a combination of ingenuity of method plus the facility of a good automatic to effect an 18-cent production saving per piece.



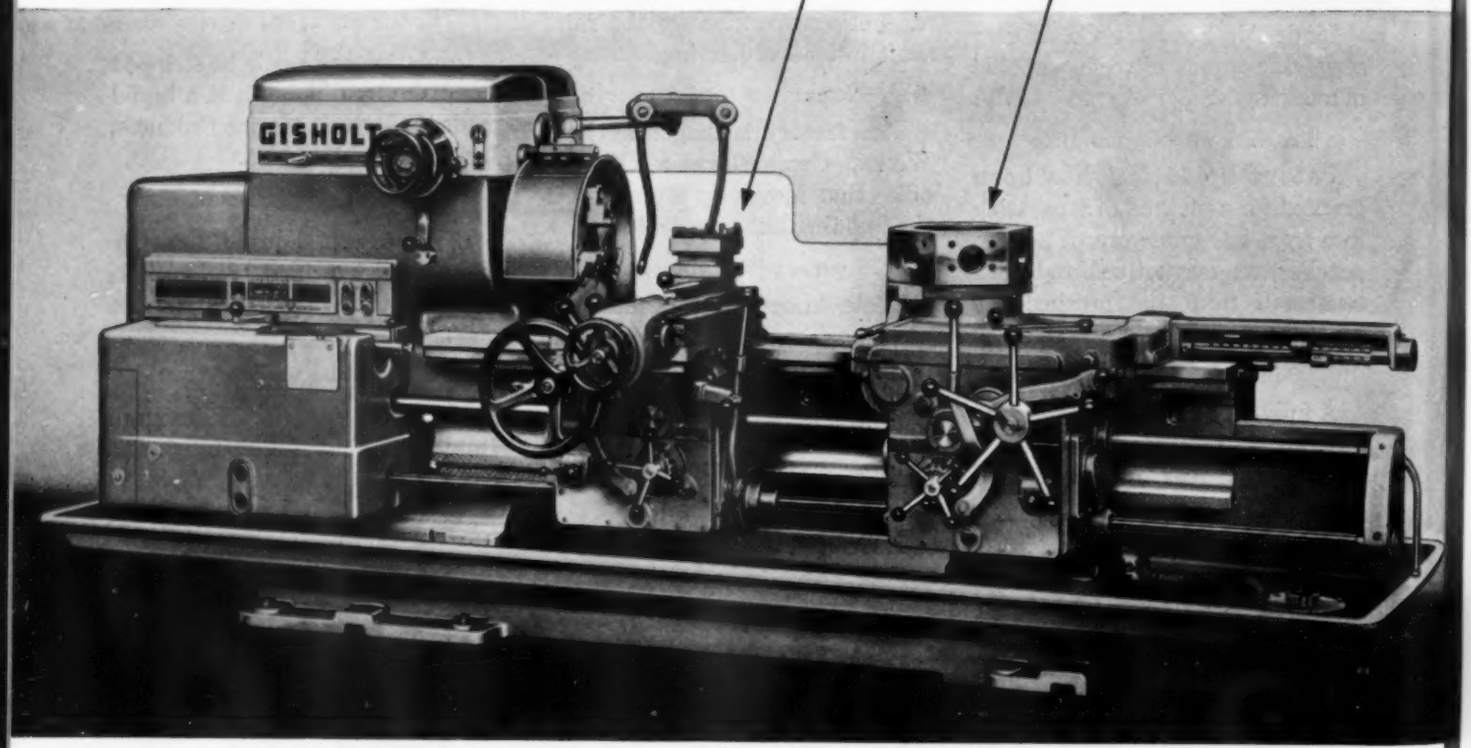
Cross section showing interior

CONE AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT, U.S.A.
53

RIGID TURRETS!

—for Rigid Standards of Accuracy!

It's one of the reasons why seasoned production men insist on Gisholt. The square turret tool post and hexagon turret are positioned by double-beveled clamping rings which provide exceptional clamping pressure with easy hand motion. Moreover, on each indexing operation, turret faces are rigidly locked in true position by hardened and precision-ground locking pins to insure unfailing accuracy.



GISHOLT ACCURACY is further enhanced by a heavy unit-cast head stock and bed which insures real rigidity. Bedways of hardened steel (64-66 Rockwell C) are ground in perfect alignment with the spindle. And they are virtually wear-proof. If you want accuracy, insist on Gisholt.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

How CARD'S CERTIFICATION Double-Checks Factory Inspection

Periodically, Pittsburgh Testing Laboratory buys Card Taps on the open market. These samples are then thoroughly laboratory-tested for such requirements of cutting quality, as hardness and dimensional accuracy . . . and the results are certified.

This double-check on quality backs up every Card Tap. It's *the extra step beyond our own rigid inspection* that makes sure that these Card Tools will give you long, satisfactory service.

For prompt deliveries and helpful cooperation, contact your nearby Card Distributor.

The CARD Quality

TAPS

The Certified Cutting Tools*

*by the Pittsburgh Testing Laboratory

Also makers of DIES • SCREW PLATES
DIE STOCKS • TAP WRENCHES

S. W. CARD
MANUFACTURING CO.
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

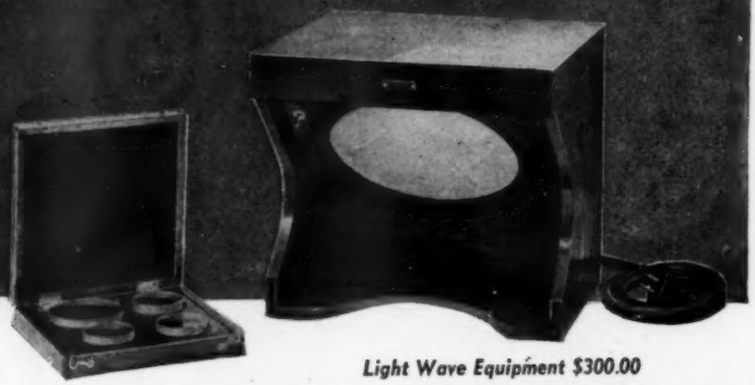
Van Keuren

LIGHT WAVE EQUIPMENTS are the proof of Precision

Detecting worn spot on amplifying gage anvil.

Checking flatness of lapped shoulder on a shaft with a special 3" diameter x 29/32" hole Fused Quartz Optical Flat.

Checking the flatness and parallelism of a micrometer anvil and spindle with a 1¼" diameter Van Keuren Fused Quartz Optical Parallel.



Light Wave Equipment $300.00

Twenty-eight years ago, when the Van Keuren Light Wave Equipment was introduced to American Industry, measurements in Millionths of an inch seemed visionary and unnecessary. Today's and tomorrow's production requirements are specified in Micro-inches (millionths of an inch) and the ability to measure in these units is no longer visionary but a *must*.

The Van Keuren Light Wave Equipment includes a set of 4 self-checking double surface FUSED QUARTZ optical flats and an improved, instant starting 60 cycle 110 volt, minimum heat monochromatic light (light of one wave length or color).

Fused Quartz is highly transparent. It is extremely hard and has exceptional wearing qualities. It is free from strain and will not change its shape with time. Its expansion and contraction due to temperature change is less than that of any other known material. It is an ideal material for optical flats.

Insist on having Van Keuren optical flats. They are beautifully finished and are of superlative accuracy on both sides. They are the best buy.

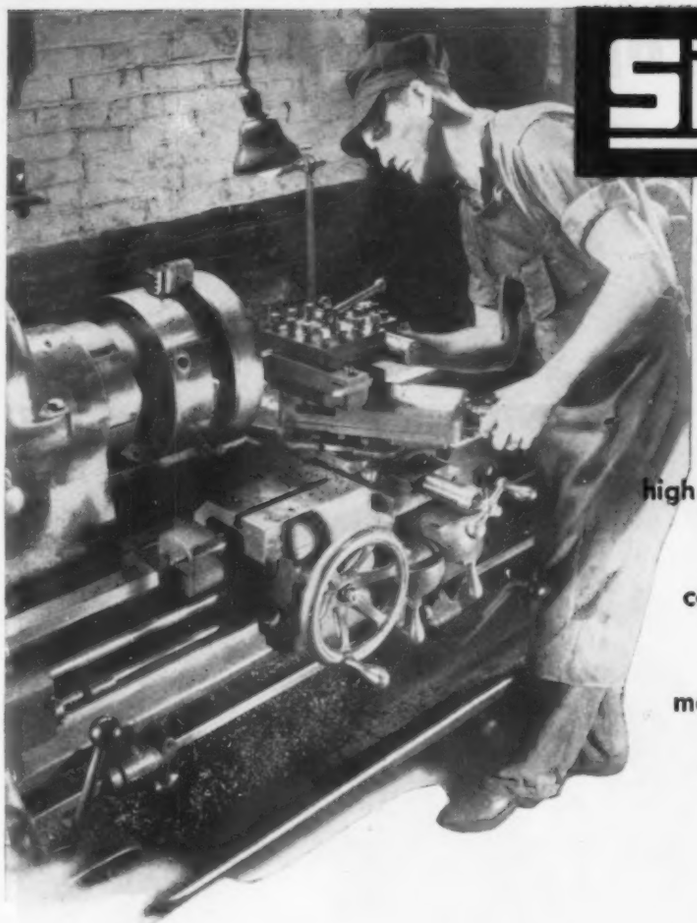
Every plant that uses amplifying gages, measuring machines or gage blocks should have a Van Keuren Light Wave Equipment for the maintenance of these expensive tools. The equipment will instantly detect worn spots and grooves in anvils and measuring contacts, which if are not known will lead to false results. The equipment will check the flatness, parallelism and make size comparisons of gage blocks in one operation, and with elimination of temperature errors. Full instructions showing practical applications are supplied with each equipment.

The new 1948 VK Catalog and Handbook No. 34, is a 208 page manual indispensable for engineers, designers, inspectors, toolmakers and machinists. It contains simplified formulas and accurate tables for measuring spur gears, helical gears, splines and worms. New and epoch making formulas and tables are presented for the first time for the exact measurement of 29°, 40° and 60° single and multiple start screw threads and worms. It includes a complete resume of American and European screw thread systems, new methods of measuring included angle of screw threads, a new method of inspecting flat ring seal surfaces with light waves, and other valuable information. Price $1.00 each postpaid.

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

29th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

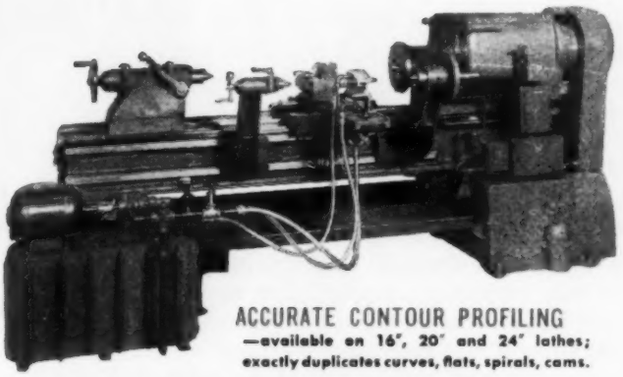


SPRINGFIELD

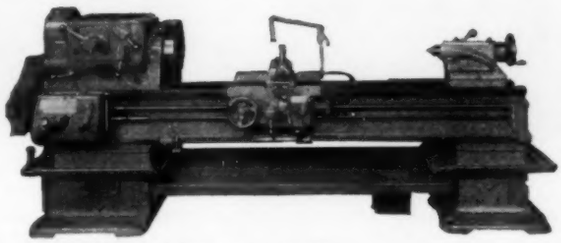
Geared Head LATHES

Springfield builds a complete line of precision, high quality, geared head lathes. Every type of lathe built by Springfield is especially designed and constructed to meet all the requirements of modern tooling, and to retain extreme accuracy through many years of full capacity production.

Write for catalogs and detailed specifications.

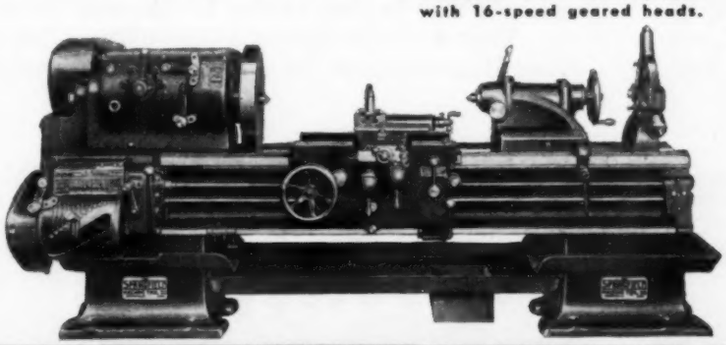


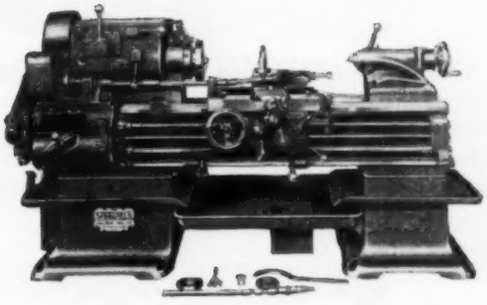
ACCURATE CONTOUR PROFILING
—available on 16", 20" and 24" lathes; exactly duplicates curves, flats, spirals, cams.



MANUFACTURING LATHE
—with unusually wide applications; capable of accurately turning, boring and facing.

SUPER DUTY LATHES
—made in 20" and 22" sizes; equipped with 16-speed geared heads.





TOOL ROOM LATHES
—made in all sizes including 24"; equipped with lead screw reversing mechanisms.

THE SPRINGFIELD MACHINE TOOL COMPANY

SPRINGFIELD, OHIO, U. S. A.

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 WEST MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

A new and better approach

to hobbing costs

BARBER COLMAN "*MULTITHREAD*" HOBS

To combine accuracy with high production and economical tool life often is a real problem in gear cutting. Machine cycle time has been reduced to a practical minimum, and so this problem centers around the cutting tool, or hob.

Barber-Colman "*Multithread*" Hobs have now been developed to the point where they represent a real solution to the problem on certain classes of work. An example of the increased machine efficiency obtained is this 14 pitch helical gear which is semi-finished in 2 minutes with Barber-Colman Ground Class A "*Multithreads*".

The reason for this high rate of production is found in the application of the multiple thread principle by which the work indexes at a faster speed which is in a direct ratio to the number of threads in the hob. Pre-shaving tolerances are easily maintained.

JOB FACTS

Operation—Hob 14 Pitch Helical Gears, 6 per Load
Machine—Barber-Colman No. 8-10
Hob—Barber-Colman Ground Class A "*Multithread*" Hob
Material—SAE 5140 80-81 R.B.
Feed—.073"/Rev. of work
Speed—150 RPM
Floor-to-Floor Time — 13 minutes per load of 6
Accuracy—Lead held within .0005", kick-out .0005", measured over balls .004" dia.

These results show the average experience with customers now using "*Multithread*" Hobs. However, in every case these tools must be accurately mounted on the hob spindle and machine conditions must be good.

These hobs may be your answer for increased productivity. They should be ordered by consulting a Barber-Colman Representative for a comprehensive analysis of your job.

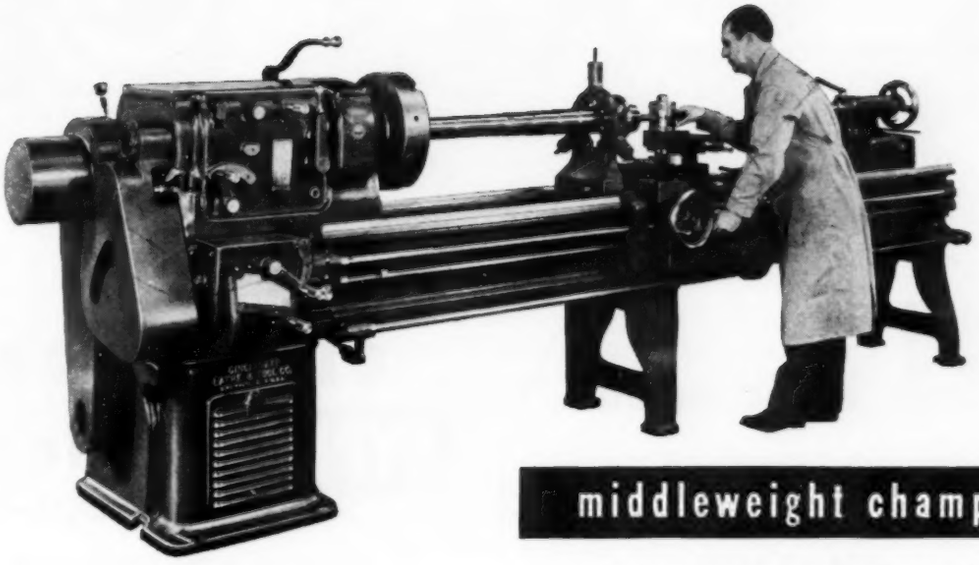
Barber-Colman Company

GENERAL OFFICES AND PLANT 114 LOOMIS ST., ROCKFORD, ILL.

BARBER COLMAN — MODERN MACHINES DEMAND *Modern* CUTTING TOOLS

The new Traytop line of light duty geared head engine lathes (10″, 12½″, 15″, and 18″ swing sizes) offers many "high price" lathe features at truly low cost: 12 spindle speeds, selected by color-coded dial; 48 thread and feed changes; exceptionally large spindles, anti-friction bearings, double-walled apron; totally enclosed gear box; many others. Distance between centers from 18″ to 60″. 15″ and 18″ sizes can be furnished with gap and gap block. Write for Bulletin T-100.

lightweight champ



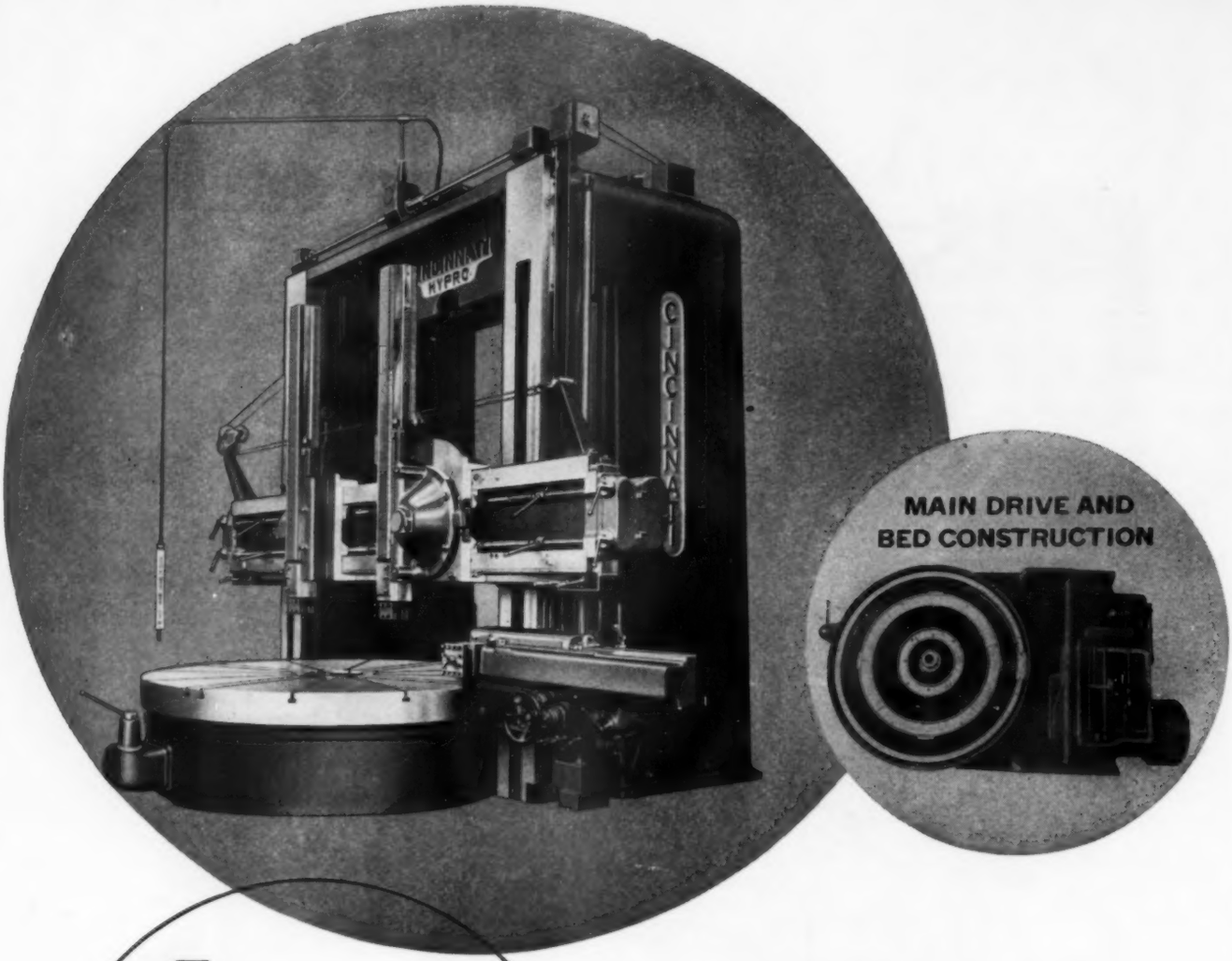
middleweight champ

In the medium duty class, the Standard line (14″, 16″, 18″, 20″, 22″, and 24″ nominal swings) assures you real all-around utility with exceptionally low initial investment; quickly pays for itself by efficient handling of practically all your turning, boring, and threading operations. 12 spindle speeds; 32 thread and feed changes; distance between centers from 32″ to 238″. All sizes available with gap and gap block. Write for Bulletin S-100.

cintilathe

OF OUTSTANDING VALUE

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO



4 MORE GOOD REASONS FOR THEIR AMAZING PERFORMANCE

CINCINNATI HYPRO Boring Mill

10-FOOT — 12-FOOT

1. One piece speed box and bed construction, providing rigidity and preventing misalignment of shafts
2. Hardened steel forged gears mounted on multiple splined shafts running in anti-friction bearings
3. Anti-friction bearing table mounting with 3 load carrying tracks; outside track nearly full diameter of table
4. Automatic pressure lubrication to all units and parts, interlocked with main drive motor

THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Production Increased 80%

. . . by using CLE-FORGE SPECIAL PURPOSE DRILL

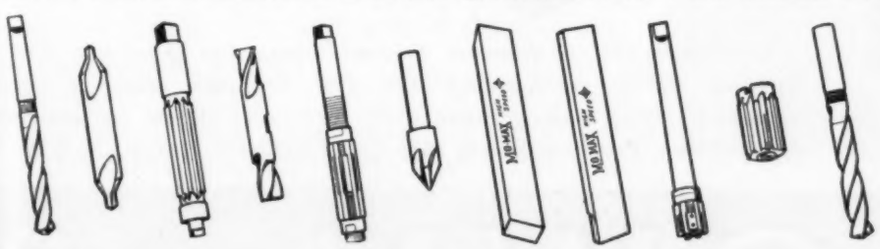
Test Shows Results of Selecting the Right Stock Drill for the Job

One of our Service Representatives, watching this screw machine operation on a stainless steel part, recommended changing from regular to a Special Purpose CLE-FORGE High Speed Drill. As a result, production was boosted more than 80% *with no increase in tool cost.* This illustrates the great importance of choosing exactly the right drill for every job. Many times you'll find that a CLE-FORGE High Speed Drill designed for special purposes will give faster production at lower cost. A CLEVELAND Service Representative will be glad to analyze *your* drilling problems, without cost or obligation. Get in touch with our Stockroom nearest you, or . . .

Telephone Your Industrial Supply Distributor.

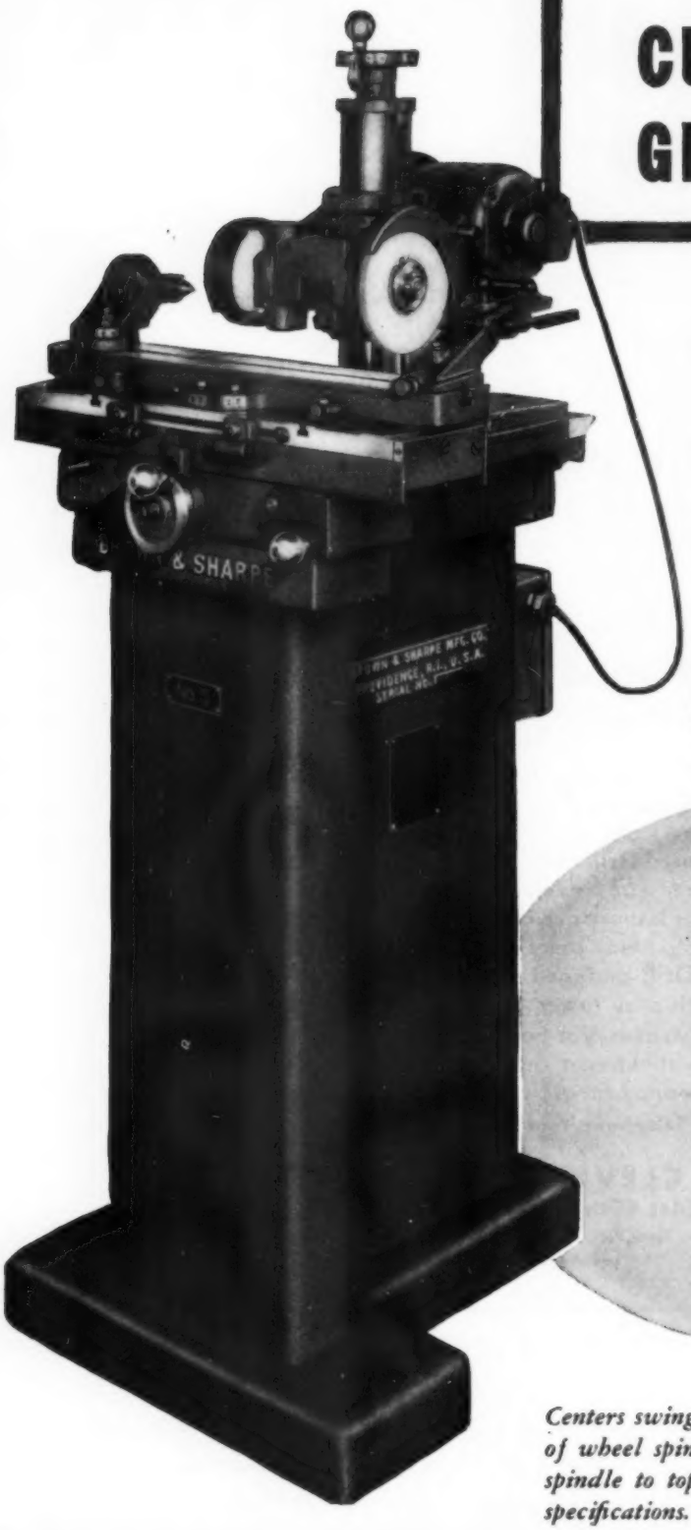
THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street **Cleveland 14, Ohio**
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5
Los Angeles 11 • London W. 3, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER CLEVELAND TOOLS



DEVELOPED TO SAVE YOU MONEY

THE NEW No. 5 CUTTER AND TOOL GRINDING MACHINE



UNIQUE FEATURES

- ✓ **Double-ended ball bearing wheel spindle (super-precision, permanently-sealed, grease-lubricated bearings).**
- ✓ **Ingenious, roller-bearing table.**
- ✓ **4-location table crank or knob.**
- ✓ **Hollow, one-piece base, mounted on 3 points to preserve alignment.**
- ✓ **Additional equipment: Indexing equipment; Raising Blocks; Formed Cutter Sharpening Equipment; Collets for No. 5 & No. 7 B & S Taper Shanks; Draw-in Bolt; 3/8" and 3/4" Cutter Bars.**

Rear view shows simplicity and sturdiness of machine.

Centers swing 6 3/8" in diameter. Distance, center line of work to center of wheel spindle, greatest 8 1/8", least, 1 5/8". Distance, center of wheel spindle to top of table, greatest, 6 7/8"; least, 1 3/8". Write for complete specifications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BROWN &

Y ON CUTTER AND TOOL GRINDING

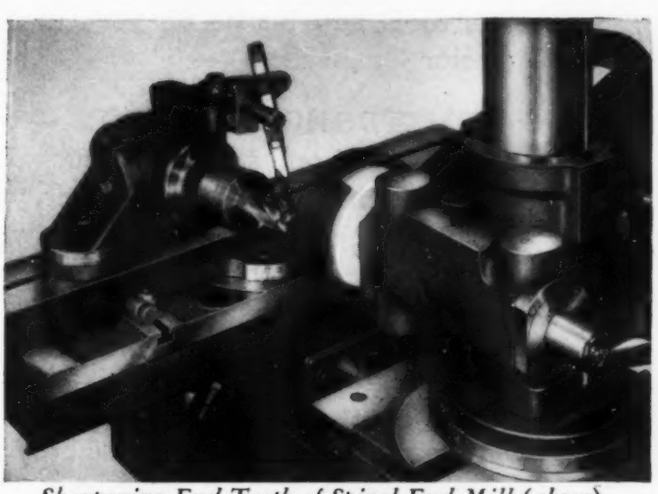
NEW OPPORTUNITIES

are now available for important improvements in your tool room efficiency through the compact, versatile and extremely sensitive Brown & Sharpe No. 5 Cutter and Tool Grinding Machine. It is specifically designed to handle a large share of tool room sharpening jobs . . . all types of small cutters, especially end mills . . . also reamers and similar tools. Handy in size and unusually flexible, it simplifies and speeds up cutter and tool sharpening.

Easy-gliding, roller-bearing table makes operation extremely simple and accurate.

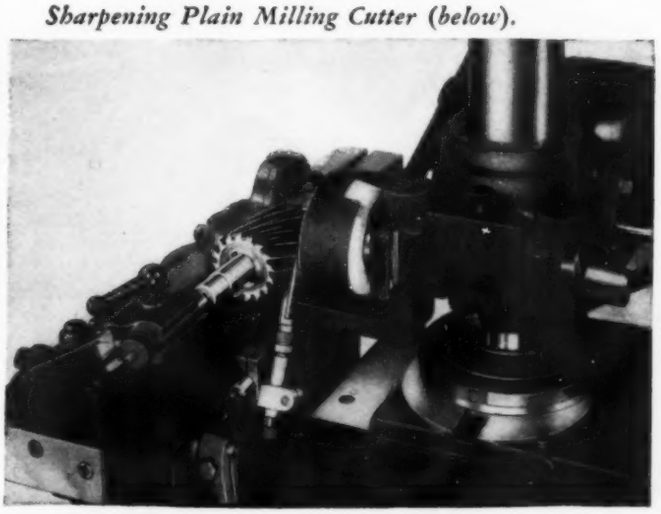
✓ SAVE ON SET-UPS AND OPERATION

The super-sensitive operation of this No. 5 machine . . . readily responsive to a light touch from the operator . . . makes set-ups and operation fast and easy. It is the result of an ingeniously-designed table which slides on 36 precision-ground rolls . . . plus lighter weight parts, engineered for fast and accurate sharpening. Most desirable work center height, conveniently located controls, and small machine size also facilitate set-ups and operation.



Sharpening End Teeth of Spiral End Mill (above).

Sharpening Plain Milling Cutter (below).



✓ SAVE ON FLOOR SPACE AND INVESTMENT

For a moderate investment, the No. 5 Machine will do much of the work that has been done frequently on larger, more expensive machines. On the basis of smaller overhead and space alone, it will reduce the unit cost of sharpening many cutters and tools.

SHARPE

B·S

ARMSTRONG

ARMALOY

Drop Forged

WRENCHES

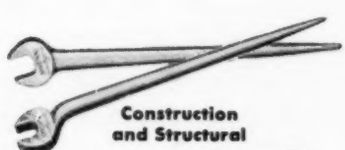
ARMSTRONG ARMALOY — Wrenches are NEW. They are designed to meet the requirements of the mechanic who knows his tools and insists on using tools of Superior Quality.

ARMSTRONG ARMALOY — Wrenches are made from selected grade alloy steel. They are longer, lighter, thinner, yet stronger than the conventional alloy wrenches—heat treated to exact specifications of stiffness and tensile strength—better balanced, hence easier to use. Finished in chrome plate with heads buffed bright.

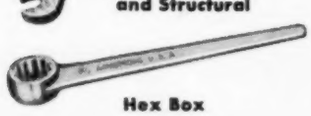
Armstrong Tools are stocked by leading tool departments.

Combination

Box Socket



Construction and Structural



Hex Box

Reversible Ratchets

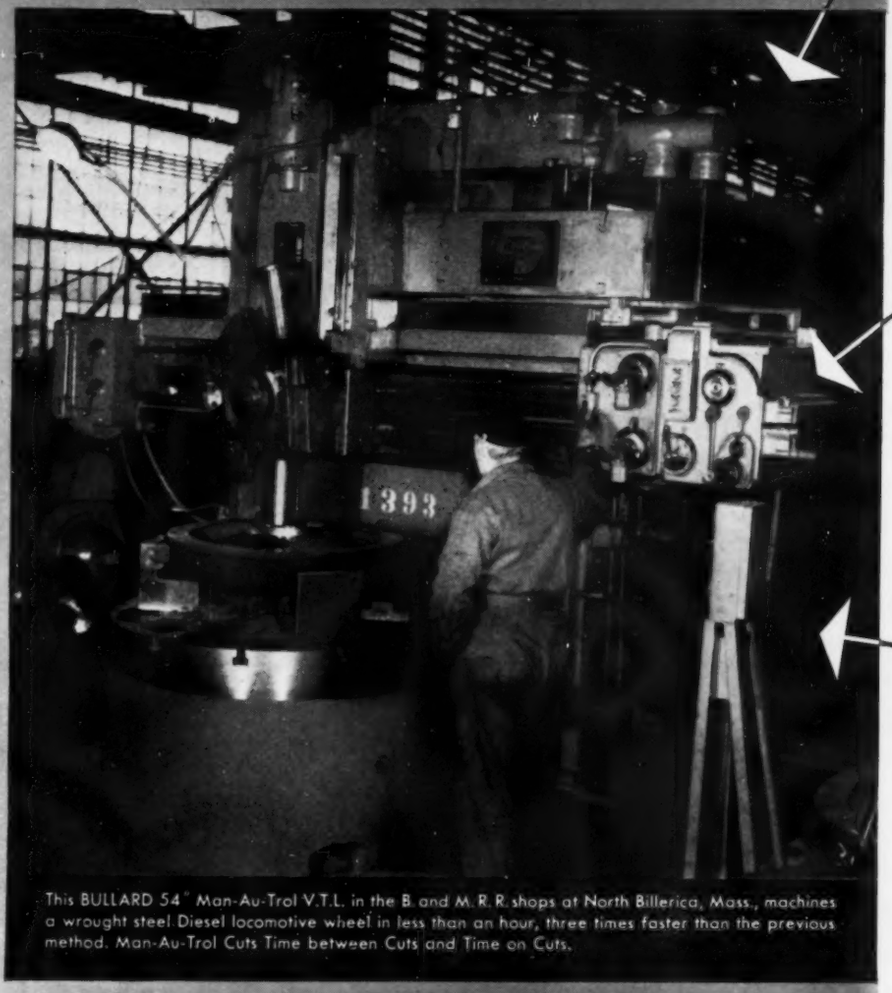
Detachable Sockets and Sets

ARMSTRONG BROS. TOOL CO.

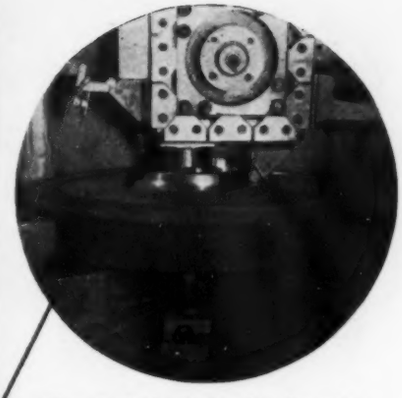
"The Tool Holder People."

5215 W. Armstrong Ave. Chicago 30, Ill.

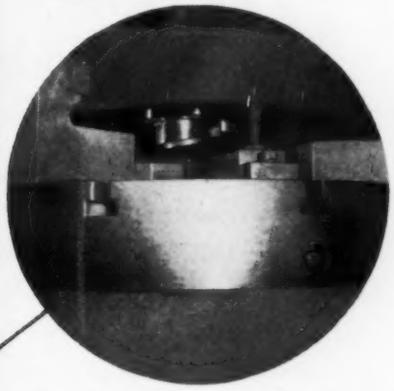
BULLARD MAN-AU-TROL V.T.L. AUTOMATICALLY MACHINES DIESEL WHEELS 3 TIMES FASTER



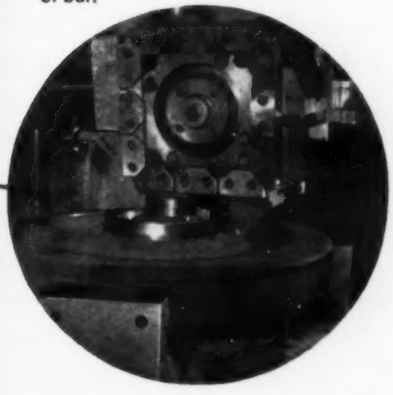
This BULLARD 54" Man-Au-Trol V.T.L. in the B. and M. R. R. shops at North Billerica, Mass., machines a wrought steel Diesel locomotive wheel in less than an hour, three times faster than the previous method. Man-Au-Trol Cuts Time between Cuts and Time on Cuts.



Here the boring tool and turning cutter on B. and M.'s Man-Au-Trol V.T.L. have nearly finished their cuts. When finished, the head moves to the right to straddle face the hub.



View from underside of wheel showing boring tool at end of cut, ready to move to the right to take straddle cut. Note lower straddle cutter on right side of bar.



Here you see the finish of the hub straddle facing operation. Now the head and bar move left to center of bore and rise to index position for next operation.

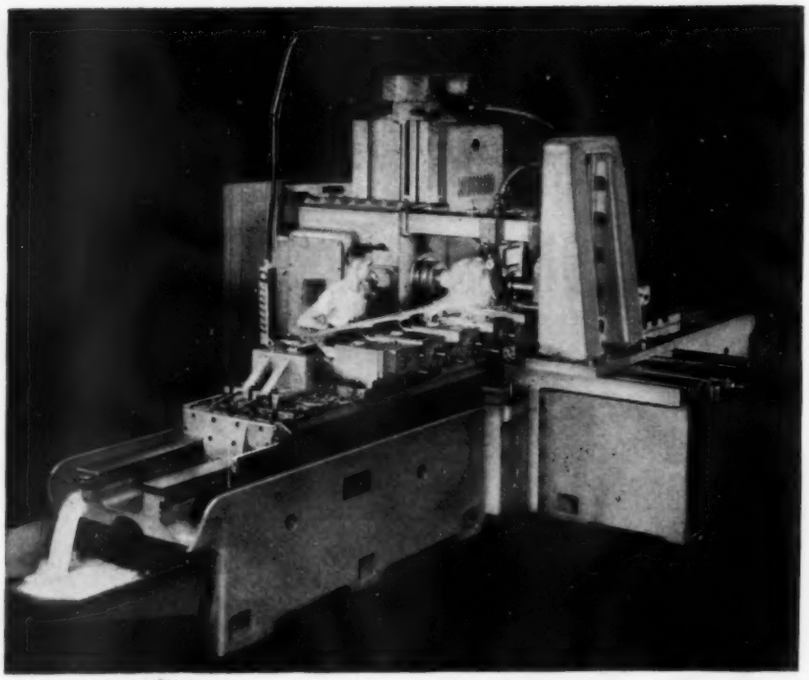
Your investigation of BULLARD Man-Au-Trol for your work will convince you that its combination of versatility, accuracy, productivity, cost-cutting ability is hard to beat. Write for Bulletin MAV-G-1, today. THE BULLARD COMPANY, Bridgeport 2, Connecticut.

BULLARD MAN-AU-TROL

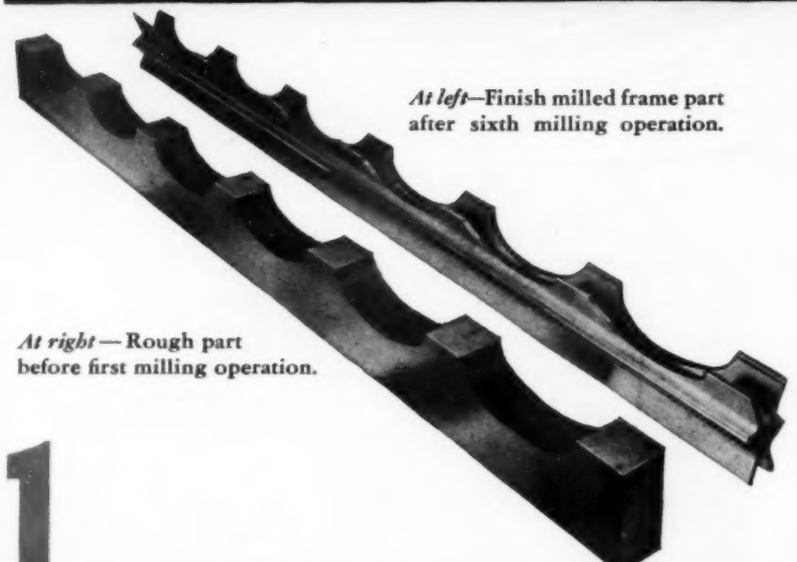
MASTER OF THE MACHINE

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

3 More Examples of BETTER MILLING METHODS FROM SUNDSTRAND "ENGINEERED PRODUCTION"



Basically, there are two approaches to solving milling production problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary . . . This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work. Check these actual examples which reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.



At left—Finish milled frame part after sixth milling operation.

At right—Rough part before first milling operation.

1

Milling Diesel Locomotive Frame Splines on Standard 50 H. P. Rigidmil

Here's a job that really requires a rugged machine. Six milling operations are performed on the splines removing 438 lbs. of 1020 steel. The standard Model 66 Rigidmil weighs 78,000 lbs., has a single spindle driven by a 50 H. P. motor. The horizontal head is provided with 40″ power vertical adjustment, and the table is provided with 168″ longitudinal feed. One universal vise type fixture with 3 sets of interchangeable jaws holds the part for all six operations.

SUNDSTRAND MACHINE TOOL CO. · ROCKFORD ILLINOIS U.S.A.

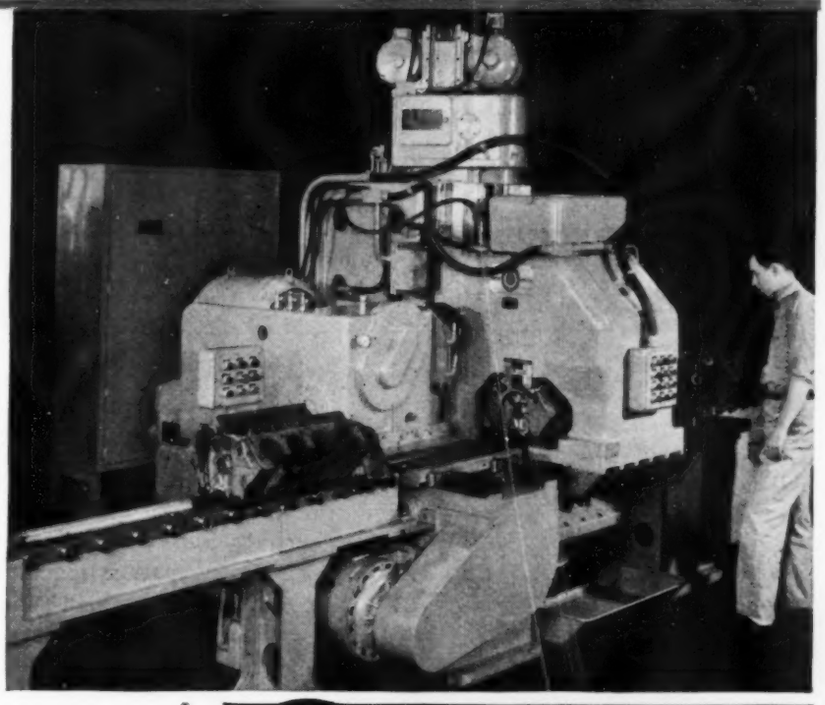
RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

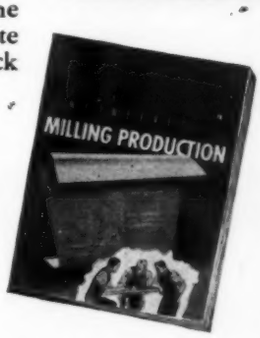
2 Milling 84 Type Bar Slots Automatically On Semi-Standard Rigidmil

This standard Rigidmil has been provided with a special 2 spindle horizontal head and a special Sundstrand automatic index base. The work holding fixture mounted to the automatic index base holds one part. The part has 84 slots — 42 in upper half and 42 in lower half. In using the automatic index in conjunction with an automatic machine cycle, all 84 slots are milled automatically with only one handling of the work piece. The cut is of the "plunge" type. Three different sizes of parts are machined on this Rigidmil.

3 Special Rigidmil Mills Both Ends and Bearing Faces on Cylinder Blocks

This special Sundstrand Rigidmil mills the ends and bearing faces of a cylinder block with one automatic locating and clamping of the part. The block enters loading position onto hydraulically operated shuttle. In an automatic cycle started from push button station, the block is shuttled into a rise and fall fixture where it is hydraulically clamped. Two 15 H. P. opposed horizontal heads feed simultaneously to face mill both ends of block; at end of stroke, cutters retract and heads rapid return. Fixture then feeds downward to straddle mill main bearings. When straddle milling operation is completed, fixture rises, and clamps are released, ending the cycle. At start of next automatic cycle, the finished block is shuttled out the opposite side of fixture as another rough block enters.





Free Data Write for more proof of the successful application of Sundstrand "Engineered" milling production. This new 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for Bulletin No. 174

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND

MACHINE TOOL COMPANY

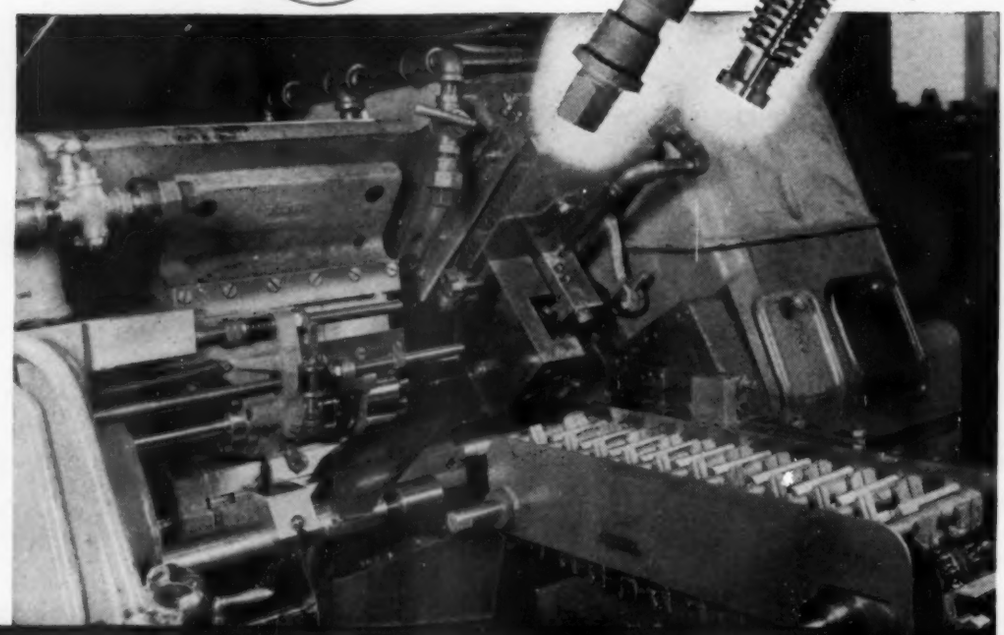
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

FOR FINE FINISH--

NAMCO

VERS-O-TOOL



Here's what NAMCO Vers-O-Tools can do for you . . .

● On this job, they're producing a 5 to 8 micro-inch body finish on a 5¼" x ¾" bronze valve stem. Three Vers-O-Tools are used; one for hollow milling the 3" shank, with carbide-tipped circular cutters and two with ground thread circular chasers for threading. Complete freedom from tool drag makes for finish; uniform concentricity insures fit.

The part is machined on a 1¼" Acme-Gridley Bar Automatic with chain-type magazine feed. For the 11 operations, including the three with Vers-O-Tools, the total machining time is 8.5 seconds.

Such speed and precision is typical. Vers-O-Tools and Acme-Gridley Automatics are an ideal combination to give you more good pieces in the pan. May we show you how their inherent adaptability suits them for *economical production* in your shop?

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

production sharpening • precision sharpening

IT'S ALL THE SAME ON THE 6-5

The ease with which precision sharpening is accomplished on the No. 6-5 Hydraulic Hob Sharpening Machine, is demonstrated in this actual job record.

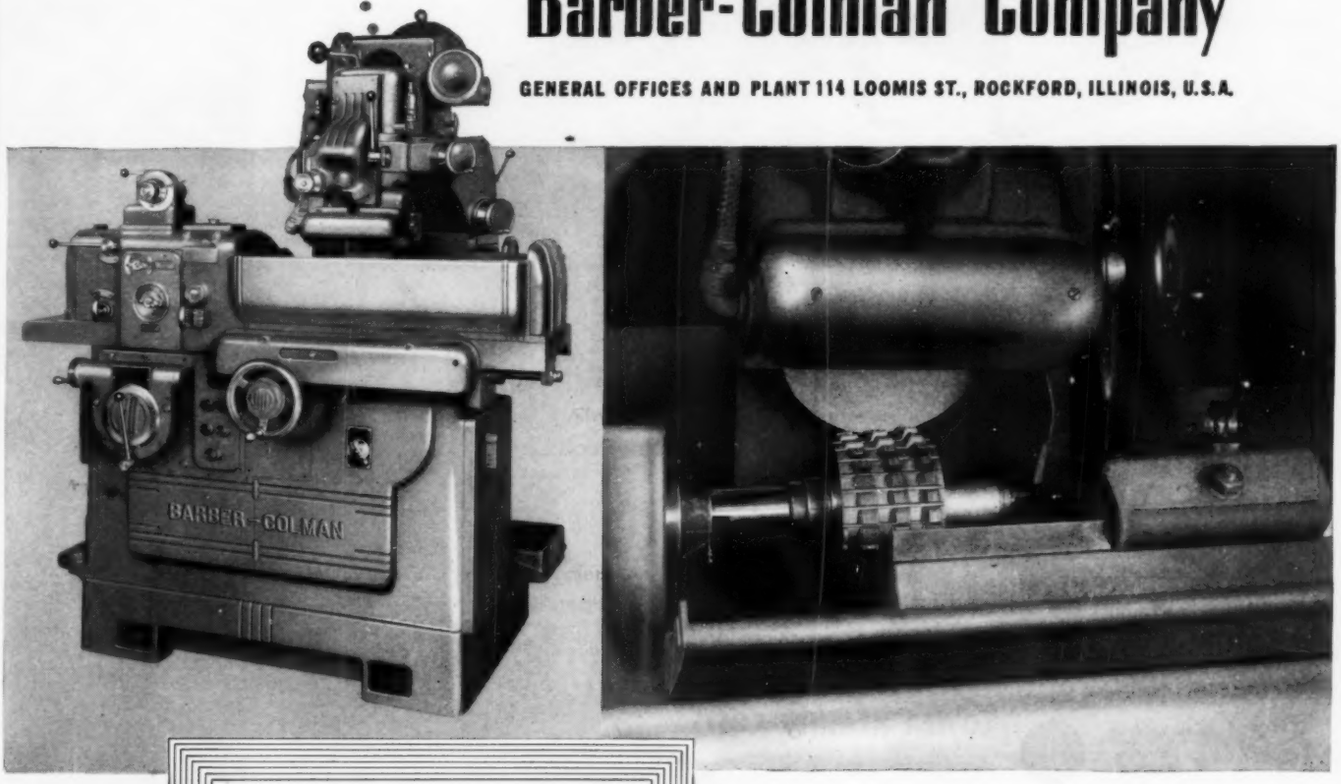
This application shows the accuracy obtained when sharpening large diameter, taper root spline hobs. These hobs are 5" in diameter, with decreased cutting depth from the large to the small end for hobbing a tapered root diameter on spline shafts, and are made with 26 teeth to produce excellent finish with a fine feed mark pattern.

When sharpening with ordinary methods, deflection of the wheel sometimes occurs as the wheel pressure against the teeth diminishes toward the shallow depth. This condition is eliminated on the No. 6-5 because of the rigidity built into the wheel head, and the precision control provided over indexing and table travel. Sharpening tolerances maintained on a complete lot of 20 hobs are shown.

Write for complete information on the 6-5 Machine. Ask for Bulletin 3212.

Barber-Colman Company

GENERAL OFFICES AND PLANT 114 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.



JOB FACTS

Operation — Face sharpen Taper Root High Speed Steel Spline Hobs to class AA tolerances

Hobs—5" diameter x 3-1/2" face

Gashes—Straight
Cutting Faces—Radial
Depth of Grind—25/64"
Wheel—7" Carborundum
Stock Removed—.010"
Feed per Rev.—.0005"
Wheel RPM—3600
Coolant—Micro-Grind

Accuracy—Adjacent spacing—.0005"
Non-adjacent spacing—.001"
Radial faces—.0003"

BARBER COLMAN — EASIER, MORE ACCURATE HOB SHARPENING...

YOU CAN *Electronically*

YOU CAN:

1. **RECOVER MORE OIL**
   Salvage as much as 5 gallons of cooling oil per day on individual machine tools.

2. **SAVE ON CLEANING COSTS**
   Precipitron greatly reduces costly cleaning of ceilings, girders, lighting fixtures, pipes, ducts, columns, machines and floors.

3. **LOWER HEATING COSTS**
   Air cleaned by Precipitron can be recirculated in the shop—no warm air is wasted.

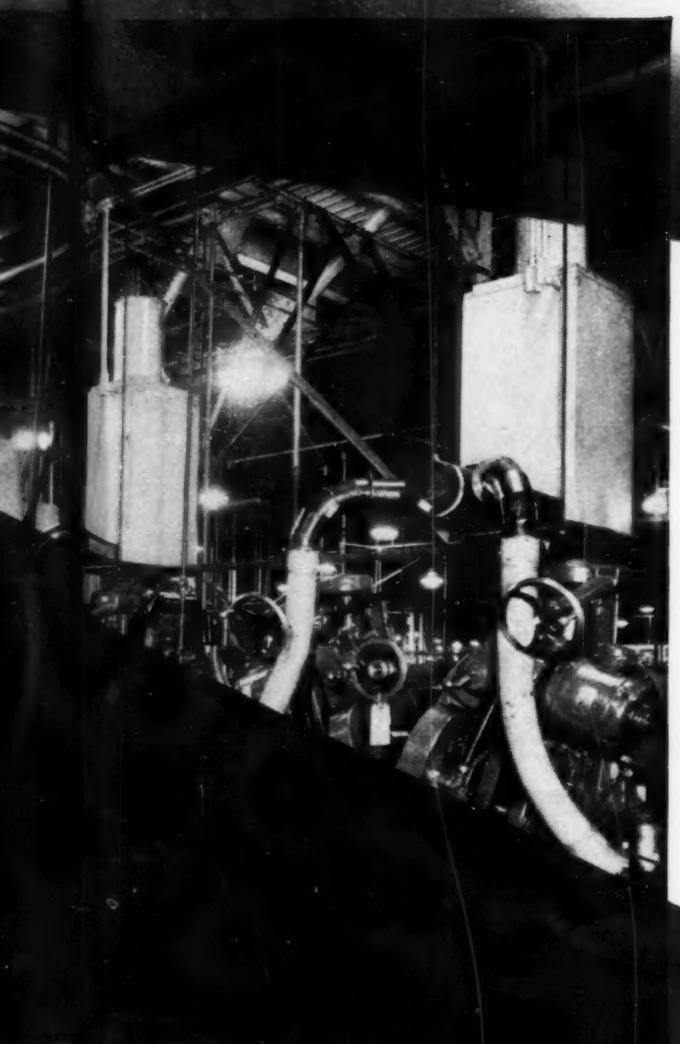
4. **ELIMINATE A FIRE HAZARD**
   Oil mist in the air and the film it forms throughout the shop means a serious fire and personnel safety hazard.

5. **IMPROVE WORKING CONDITIONS**
   Clean air and clean surroundings mean an increase in machinists' efficiency—and nothing cleans air like Precipitron.

*Trademark of the Westinghouse Electric Corporation, Reg. U. S. Pat. Off.

CUT OIL MIST LOSSES

...with Precipitron*...



HERE'S HOW:

There's only one effective way to deal with oil mist — it's the electronic principle of Precipitron! Precipitron captures oil mist at its source — traps it right on the machine tool using oil coolant. The oil is separated from the air — electronically. Clean air is returned to the shop and a substantial quantity of oil is gravitated back to the oil reservoir.

Independent research organization tests prove Precipitron to be from 94% to 97% effective in the reduction of *oil mist*.

Precipitron may be installed for both individual and multiple machine tool applications. Its maintenance and cleaning costs are low . . . no moving parts to wear and repair. Plants that have eliminated oil mist with Precipitron find that savings in shop maintenance and recovered cooling oil alone, will pay for the installation in a comparatively short time.

Call your nearest Westinghouse office, or write to: Westinghouse Electric Corporation, Sturtevant Division, 89 Readville Avenue, Hyde Park, Boston 36, Mass.

Westinghouse

Sturtevant Division

J-80116

Rock Crusher Drive Proves the Durability of *Texrope* *Super-7* V-belts!

Load! Shock! Grit! All these demons that destroy V-belts are present in this powerful rock crusher drive. But *Texrope Super-7* V-belts are giving long, satisfactory service, even under conditions like this. For big drive or fractional hp—for every type of service—get these famous V-belts from your nearby A-C dealer or office.

"PRE-ENGINEERED" TEXROPE DRIVES

You can solve 90% of all V-belt drive problems, from 1 to 150 hp with economical stock *Texrope* V-belts and sheaves. New 144-page manual makes drive selection as easy as finding a number in a phone book. Ask for Bulletin 20B6956. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. *Texrope, Super-7, Texsteel, Texdrive, Magic-Grip and Vari-Pitch* are Allis-Chalmers trademarks

A Complete Range of Products		
Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
Texsteel, Texdrive, Magic-Grip	Sheaves in a full range of sizes and grooves	
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

A 2429

ALLIS-CHALMERS

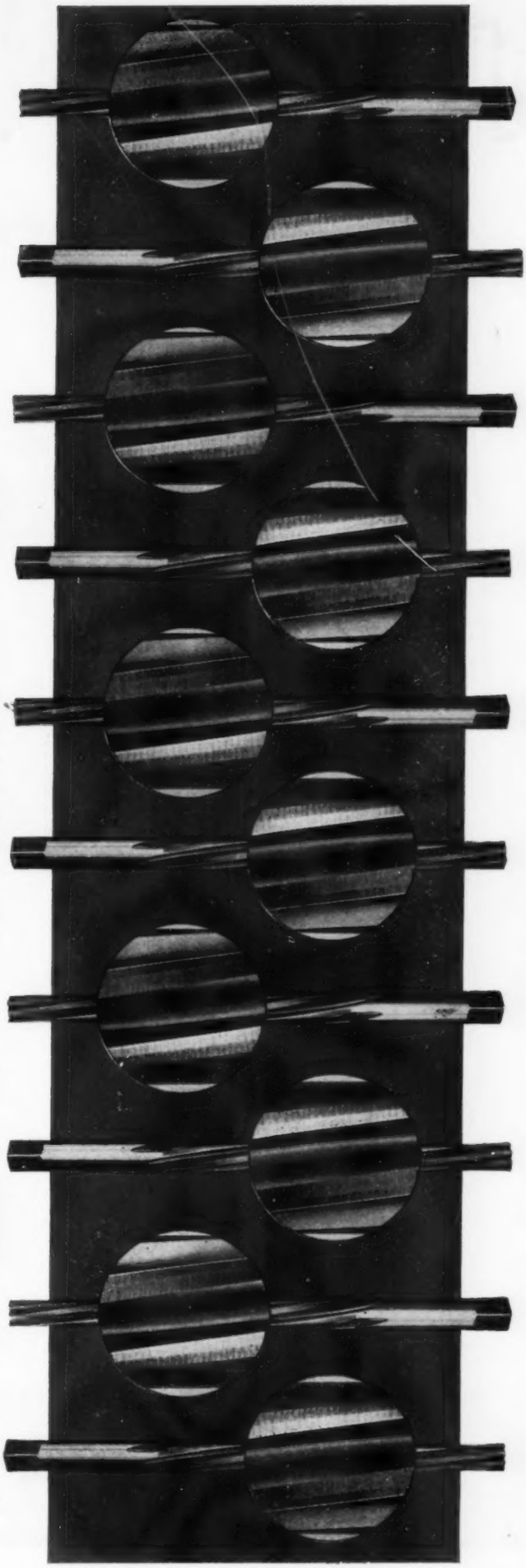
Originators of the Multiple V-belt Drive for Industry

Only 100% inspection makes UNIFORMITY certain

When you carefully examine any Butterfield Tool before you put it to work, you're not the first one to do it. Every single Butterfield Tool, from the smallest size to the largest, is individually inspected before it's considered good enough for you. Butterfield takes such pains so that you can be sure of getting uniformly good tools. Yet, you pay nothing extra for this extra assurance of getting top performance on every job.

For quick deliveries of Butterfield . . . the 100% Inspected Tools . . . depend on your nearby Butterfield Distributor. BUTTERFIELD DIVISION, Union Twist Drill Co., Derby Line, Vermont and Rock Island, Quebec.

Bar stock at Butterfield being tested for microstructure . . . one step in Butterfield's 100% Inspection.



BUTTERFIELD

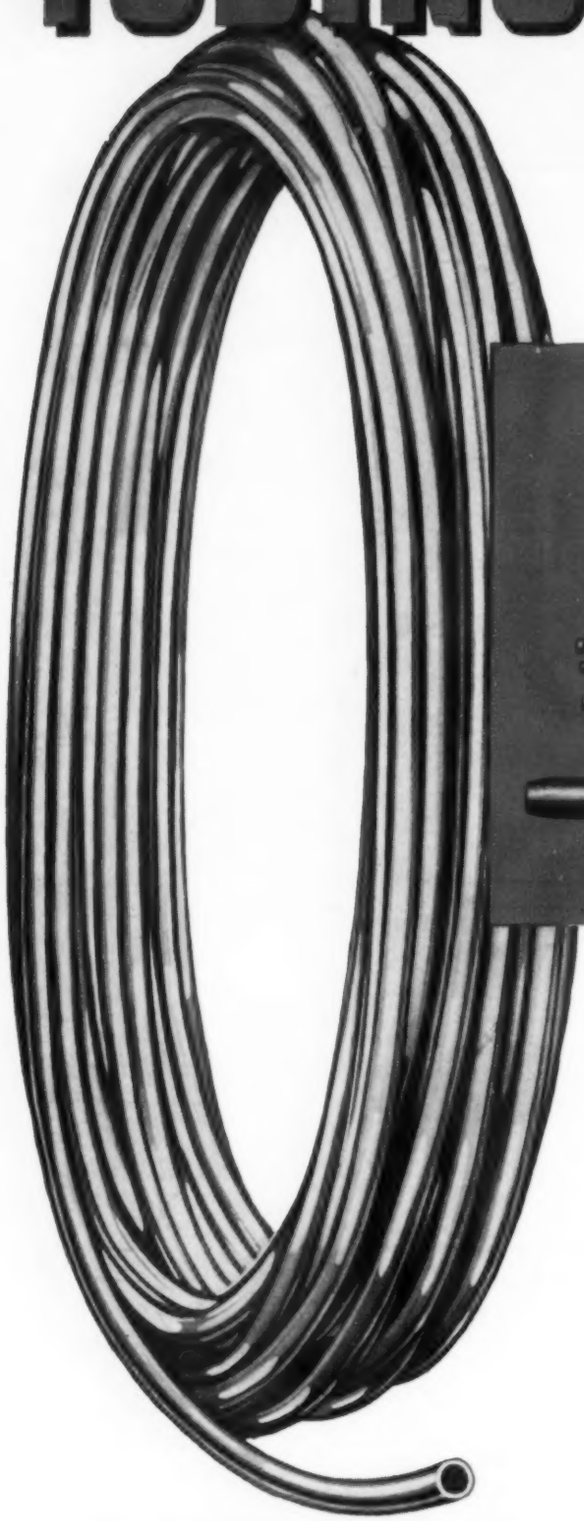
THE 100% INSPECTED TOOLS

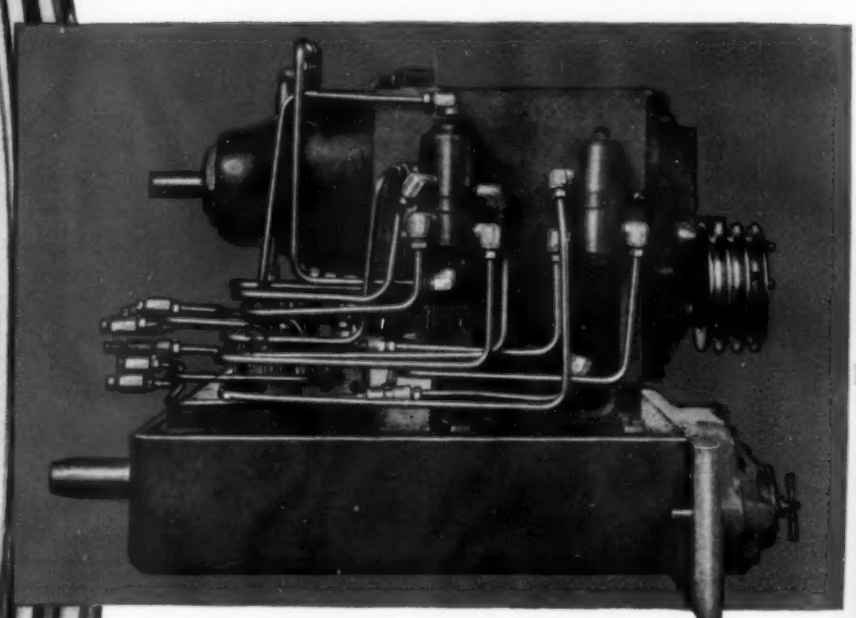
Every Tool Individually Inspected

TAPS • DIES • SCREW PLATES
REAMERS

TUBING BARGAIN

FOR HYDRAULIC CONTROLS





For this use, or for pneumatic controls, oil, gas, and refrigerant lines, Alcoa Aluminum Tubing costs less.

Alcoa Aluminum Tubing is light, yet strong to withstand hard service. It's easy to form and flare. And it's resistant to attack by most liquids, gases, and refrigerants. It cannot produce oil sludge.

Alcoa Aluminum Tubing is made in a wide range of diameters and wall thicknesses, and also in special alloys that stand up to severe vibration.

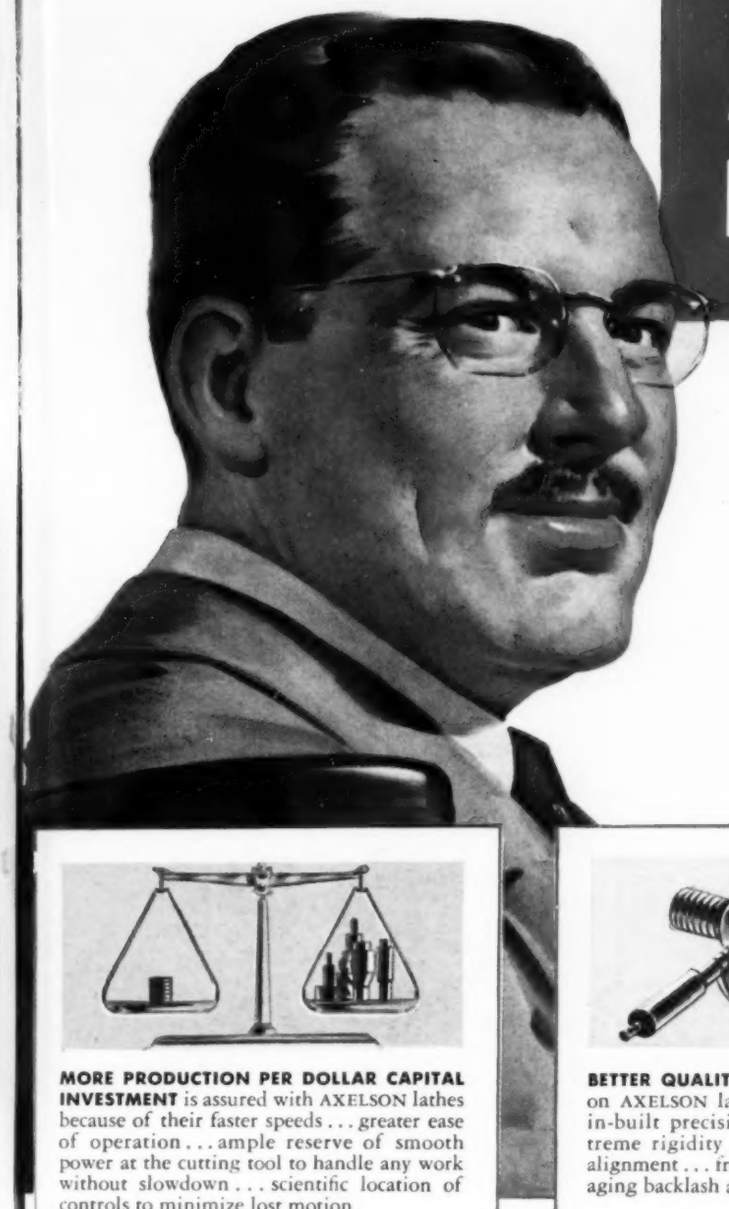
Ask your Alcoa Distributor for Alcoa Aluminum Tubing. Distributor stocks are located in 24 strategic cities. Or call your local Alcoa sales office.

ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Penna.

ALCOA

ALCOA *Aluminum* TUBING

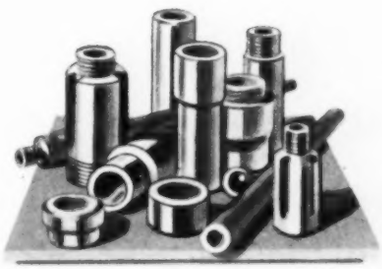
AXELSON FIRST CHOICE



MANAGEMENT EXECUTIVES AGREE a greater volume of production per man-hour and better quality work at less unit cost, is produced in their machine shops on AXELSON heavy-duty engine lathes.

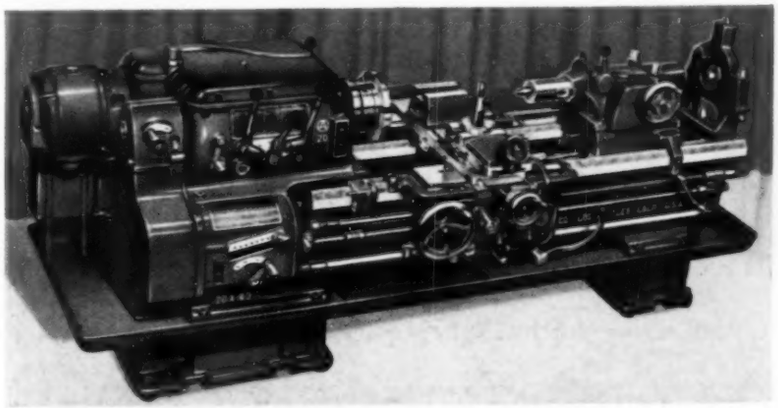
MORE PRODUCTION PER DOLLAR CAPITAL INVESTMENT is assured with AXELSON lathes because of their faster speeds . . . greater ease of operation . . . ample reserve of smooth power at the cutting tool to handle any work without slowdown . . . scientific location of controls to minimize lost motion.

BETTER QUALITY WORK is produced on AXELSON lathes because of their in-built precisioned accuracy . . . extreme rigidity to maintain positive alignment . . . freedom from tool-damaging backlash and chatter.



WIDER RANGE OF APPLICATIONS means fewer machine tools needed to handle the work load . . . two-speed tailstock . . . built-in reverse clutch . . . designed for modern high-speed and carbide-tipped tooling.

LONGER LIFE—LESS MAINTENANCE with AXELSON lathes, cut depreciation and plant overhead . . . reduce to a minimum production shutdowns for maintenance or repair . . . provide years of added precision work at no replacement cost.



THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

FREE

TO PLANT EXECUTIVES: *Complete illustrated literature tells the story of* AXELSON *lathes. Write today for your copy.*

AXELSON *Lathes*

DEPENDABLE FOR A THIRD OF A CENTURY

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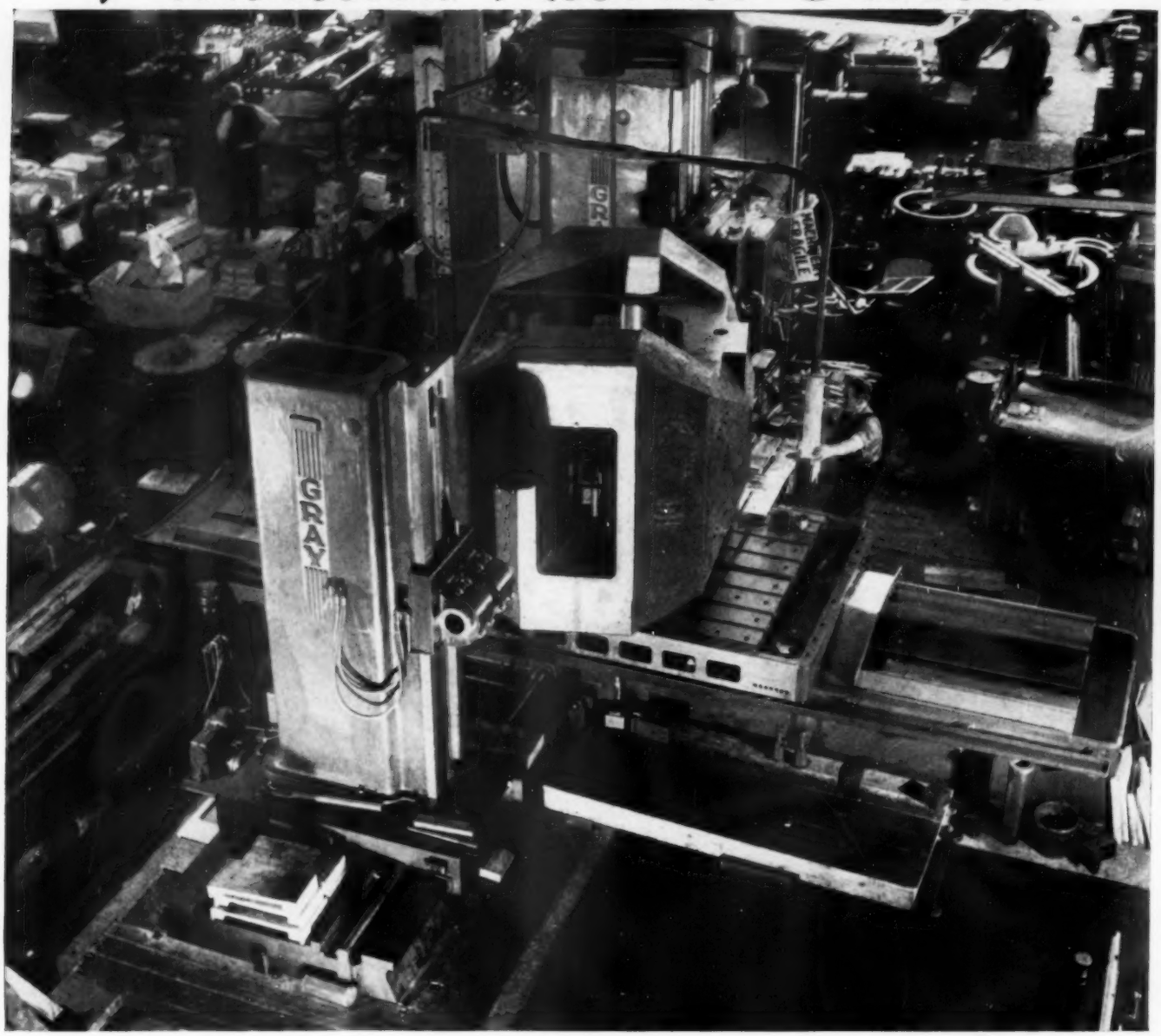
Production Records Broken!



THE simplicity and convenience of control that characterizes Gray Horizontal Boring, Drilling and Milling Machines is of special value on large work like this. These powerful, versatile machines are breaking production records throughout the country.

Write for fully illustrated descriptive Bulletins Nos. 48 & 54

The G.A. GRAY *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.

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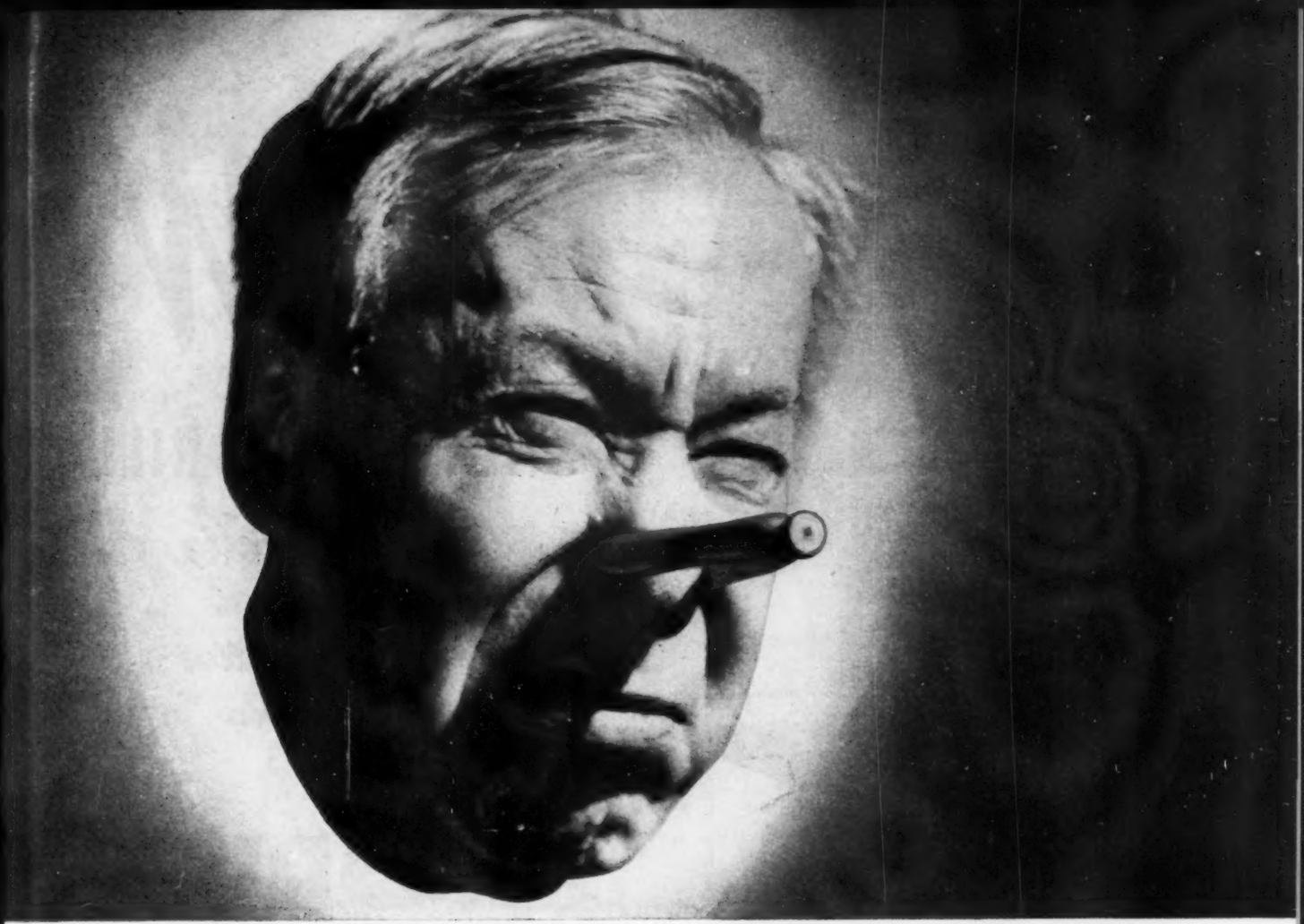


HOW TO DEODORIZE A JOB...

Every operator in your shop will realize he has a better job when you take the odor out of it. And all you have to do is specify Cimcool.

Cimcool is the revolutionary cutting fluid that isn't subject to rancidity even in the hottest weather. It's a *chemical emulsion*. Can't burn. Can't smoke. Has no objectionable odor of its own.

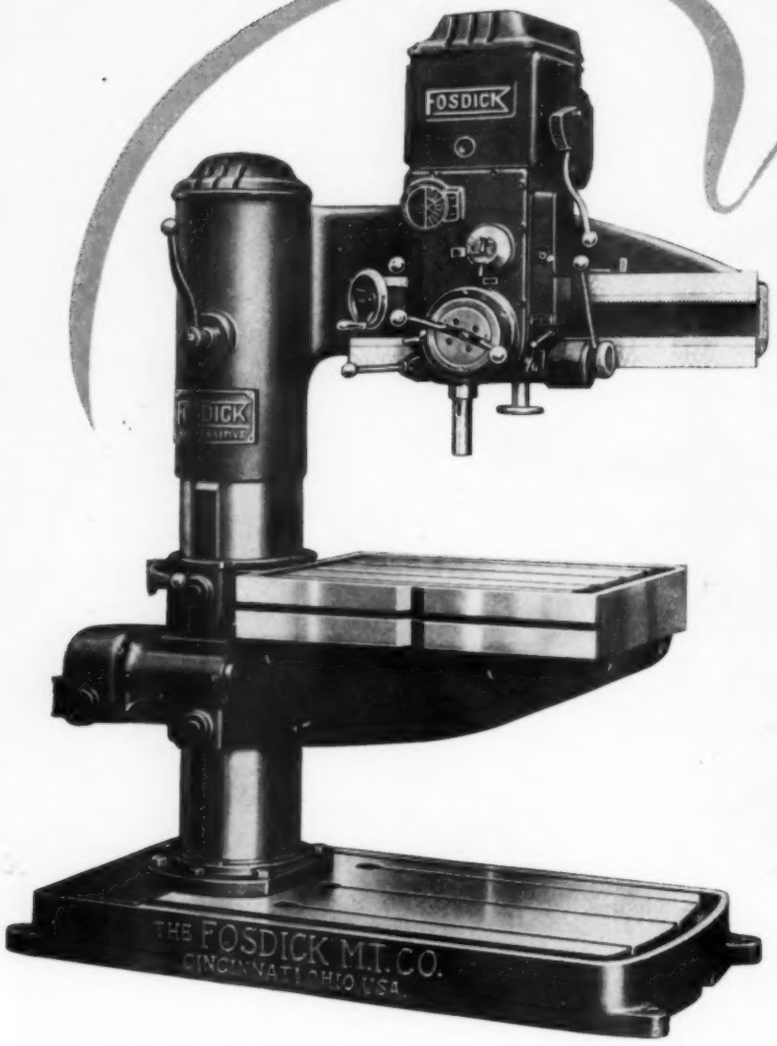
And those aren't the only reasons why operators like their jobs better when Cimcool is on the job. Cimcool is clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. Contains no skin irritants. And Cimcool cools so fast that tools and chips actually stay cool to the touch. You'll get better production when you make jobs better with Cimcool!

CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

CIMCOOL *for* 85%

Trade Mark Reg. U. S. Pat. Off.

OF ALL METAL CUTTING JOBS



NOW!

A RADIAL DRILL

Specifically designed for sensitive drilling

FOSDICK SENSITIVE RADIAL

• Since its first official showing at the machine tool show in Chicago the interest in this Sensitive Radial has been astounding.

Fosdick Machine Tool Co. being builders of both Radial and Sensitive Drills were the first concern to apply the principles of radial drilling to the sensitive field by developing the Fosdick Sensitive Radial.

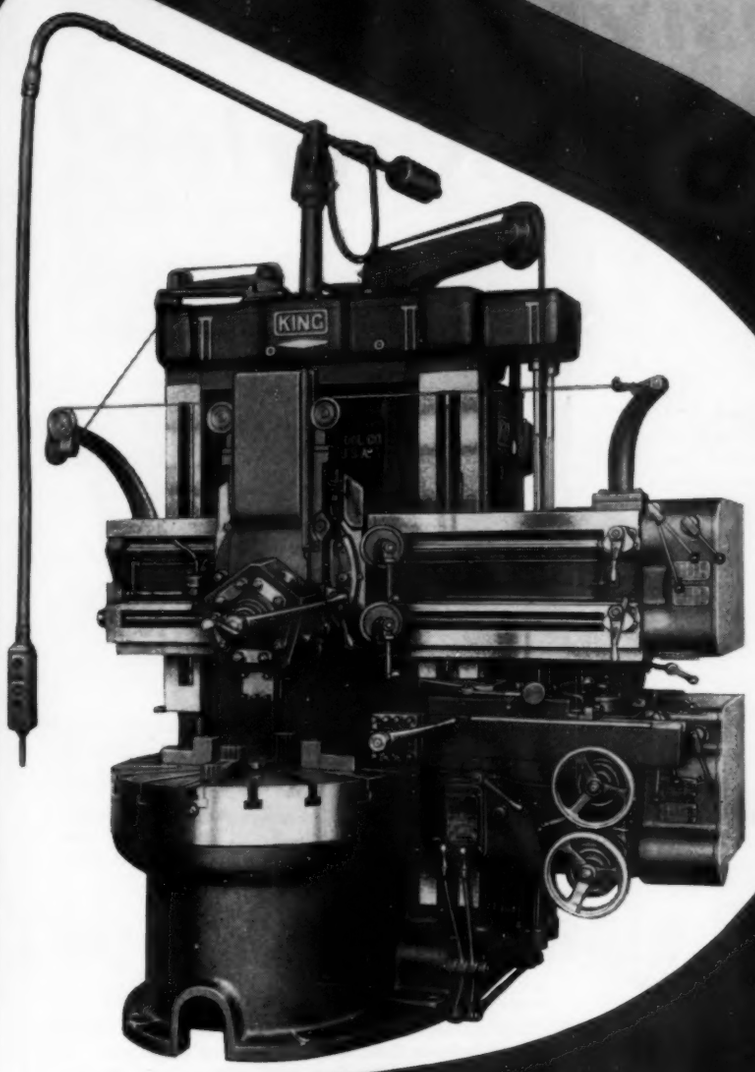
The machine is of comparatively simple design with the conventional radial drill base and new one piece column. However, it differs distinctly from the conventional radial drill in that it has a movable table and the arm is set at a fixed height. Both the table and arm may be swung in an arc of 360°. The adjustable table can be set at the correct height for the job at hand and may be swung out of the way for tall jobs mounted on the base.

The head of simple design has nine speeds and four feeds. The nine speeds are controlled by a direct reading lever at the bottom left hand side of the head. The four feeds are operated by a single direct reading lever on the right hand side of the head. The feed clutch and quick return mechanism is of entirely new design.

These are but a few of the many time and cost saving features of this Fosdick Sensitive Radial.

• *Complete details of design, construction and operation are available in the Fosdick Sensitive Radial Bulletin R.S.A. Write for yours.*

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO



Better Performance

results from

HEAVIER CONSTRUCTION

The New Series

KING

VERTICAL BORING & TURNING MACHINE

● **Tough jobs are easy jobs for this husky new series KING. Extra heavy, extra rigid, it takes heaviest cuts with dependable accuracy at highest speeds within the capacity of modern cutting tools.**

What gives a KING its added, performance-improving weight and rigidity? Many factors contribute . . . among them, the new massive rectangular type ram heads; the saddle for ram head square locked and fitted with four taper gibs for accurate alignment; the heavy tie plate across the swivel.

It will pay you to investigate the new series KING. It has the answers to your problems involving better work, faster production, lower costs.

Ten sizes available, 30" to 144". Write for full particulars.

American Steel Foundries

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CINCINNATI 29, OHIO

Builders of Vertical Boring and Turning Machines and Sebastian Lathes

THEY'RE *Exclusive*

THEY'RE *Knurled!*

"UNBRAKO" SOCKET SET SCREW —with **knurled** Cup Point — "won't shake loose." Pat. & Pats. Pend.

"UNBRAKO" SOCKET HEAD STRIPPER BOLT — with **knurled** Head and Threads—"won't shake loose." Pat. & Pats. Pend.

"UNBRAKO SQUARE HEAD SET SCREW— with **Knurled** Cup Point (either internally or externally)— "won't shake loose." Pat. & Pats. Pend.

"UNBRAKO" cone point SOCKET SET SCREW — with **Knurled** Threads — "won't shake loose." Pat. & Pats. Pend.

Our patented "Unbrako" Knurled Socket Set Screws and Stripper Bolts will lock themselves in most any screw application. They won't shake loose. Millions and millions in use. Knurling of Socket Screws originated with "Unbrako" in 1934.

"UNBRAKO" SOCKET HEAD CAP SCREW — with **knurled** Head — provides "slip-proof grip"

UNBRAKO

REG. U.S. PAT. OFF.

SCREW PRODUCTS

"Unbrako" Screw Products are, of course, of superior quality alloy steel. *But, the "big point"* of which we are justly proud, is our *exclusive* KNURLING feature . . . incorporated either on threads or points of "Unbrako" Set Screws, and upon the threads of our latest design Stripper Bolt, as illustrated. Consequently, each of them are transformed into *excellent* "Self-Lockers"—they positively *will not* shake loose . . . in spite of the most chattering vibration! KNURLING also provides a time-saving *slip-proof* grip on Stripper Bolt and Cap Screw Heads. The *Internal Wrenching* feature of "Unbrako" Socket Screw Products results in weight-saving, compact designs and lower production costs. Sizes available from No. 4 to 1½" diameter, in a full range of lengths. Ask for *your* copy of the "Unbrako" Catalog . . . informative and useful.

Write us for the name and address of your nearest "Unbrako" Industrial Distributor.

Any type of "Unbrako" Screws can be furnished in brass, stainless steel, monel, bronze or whatever your requirements may be.

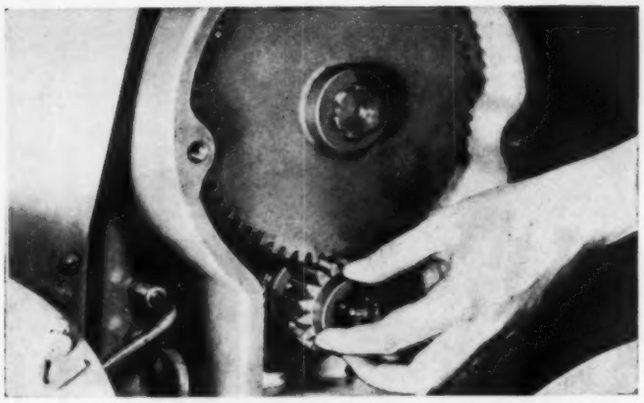
OVER 45 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

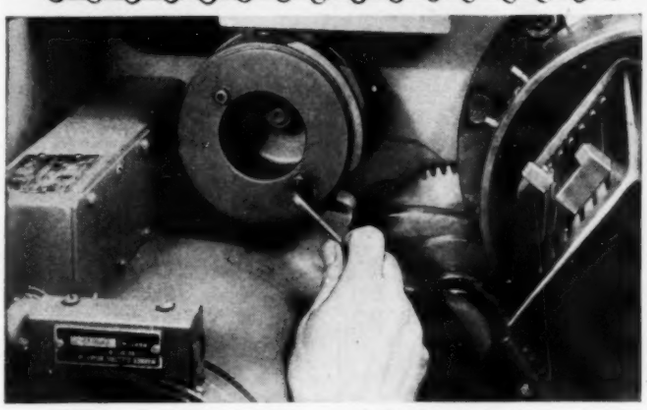
JENKINTOWN, PENNA. BOX 4

BRANCHES: CHICAGO DETROIT INDIANAPOLIS ST. LOUIS SAN FRANCISCO

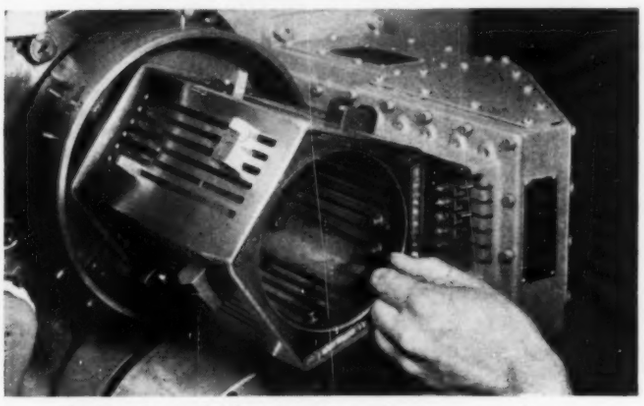
It's simpler to set up a Warner & Swasey CAMLESS Automatic



A simple pickoff gear selects the automatic speed range you desire.



Late cross slide operation and dwell is set for each slide on this rotary trip drum.



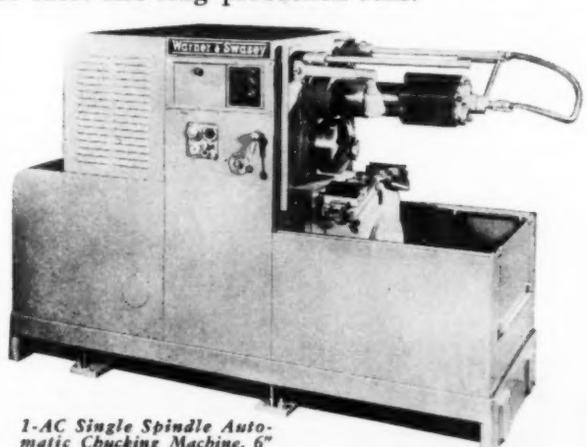
Easily adjusted "Quick-Set" mechanism controls automatic feed and speed changes and skip indexing.

The Versatile Single Spindle Automatic

HERE IS THE MACHINE TOOL that combines the flexibility of the turret lathe *and* the economy of the automatic. Camless operation eliminates expense and time lost in making, storing, finding, changing cams. Illustrations above show how setup time is cut to the minimum.

Nine big features make this *the* profitable machine for short and long production runs:

1. Eight ranges of four automatically selected speeds.
2. Any speed, within a selected range, may be set on any turret face and may be changed during the stroke.
3. Any three, out of eighteen feeds from .002" to .083", are automatically available during operation.
4. Either or both cross slides can be selected to operate with any or all turret faces.
5. Turret can be automatically skip-indexed to eliminate unnecessary approach strokes.
6. Alternative hand control of all functions.
7. Reduced number of bearing surfaces and smooth shockless indexing retain original accuracy.
8. Advanced design reduces tool overhang for less chatter, closer tolerances.
9. Adequate chip clearance and capacity. Selector valve delivers coolant to operating station only.



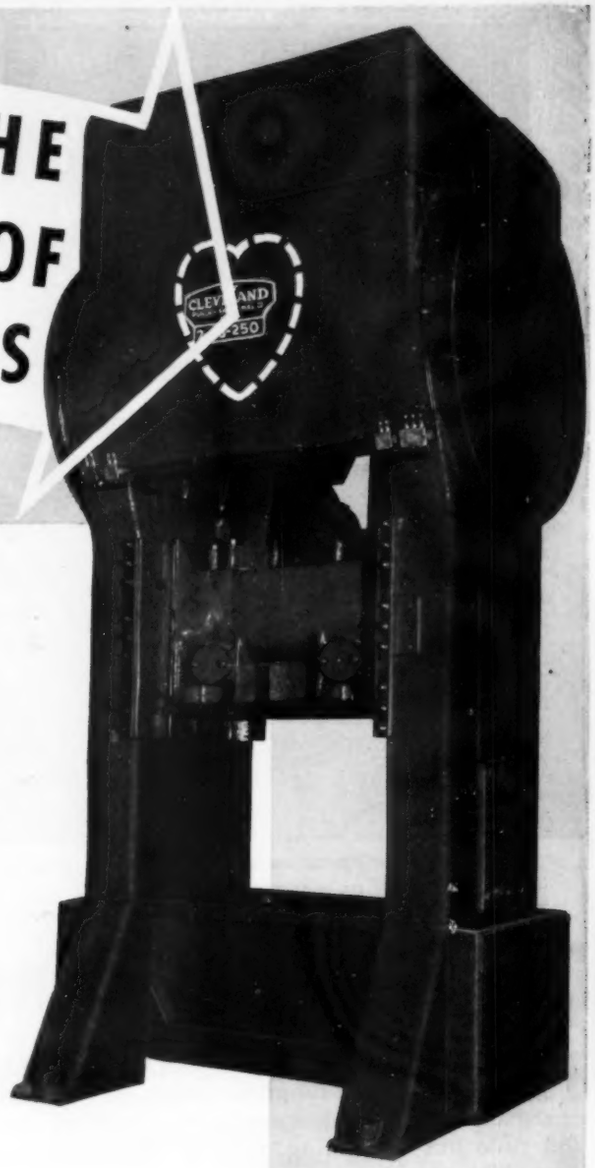
1-AC Single Spindle Automatic Chucking Machine, 6" turning length, 8" or 10" Chuck.

You can machine it better, faster, for less . . . with a Warner & Swasey

WARNER & SWASEY
Cleveland

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

THE CLUTCH IS THE HEART OF THE PRESS



Cleveland 2.48.250 Two Point Press, double geared, equipped with electrically controlled air operated friction clutch. Stroke of slide — 12″; adjustment of slide — 6″; area of bed — 36″x 48″; strokes per minute — 20; capacity — 250 tons.

And *only* Cleveland can furnish you with the new (patented) Drum Type Clutch which has *14 outstanding features for economy of operation, uninterrupted production and low maintenance.

Here is a Clutch (adaptable to any type or size of Power Press requiring an electrically controlled, air operated friction clutch) which is not only different in design and construction but *different in performance.*

For longer "life" and less "down time", specify Cleveland Power Presses equipped with the Cleveland (patented) Drum Type Air Friction Clutch with spring loaded Brake.

*Light weight — fewer parts — low horsepower required for operating — quicker stopping and starting — complete disengagement of Clutch *or* Brake — self adjusting — can be serviced *on* the Press — Clutch and Brake a combined unit — maximum performance with minimum amount of air — positive Brake, spring operated — Clutch can be set to slip — no excessive heating — for Flywheel or Geared Type Presses — mounted directly on the drive shaft

If interested in any type or size of Power Press we invite you to write for a copy of our Drum Type Clutch folder.

CLEVELAND PUNCH and SHEAR WORKS COMPANY

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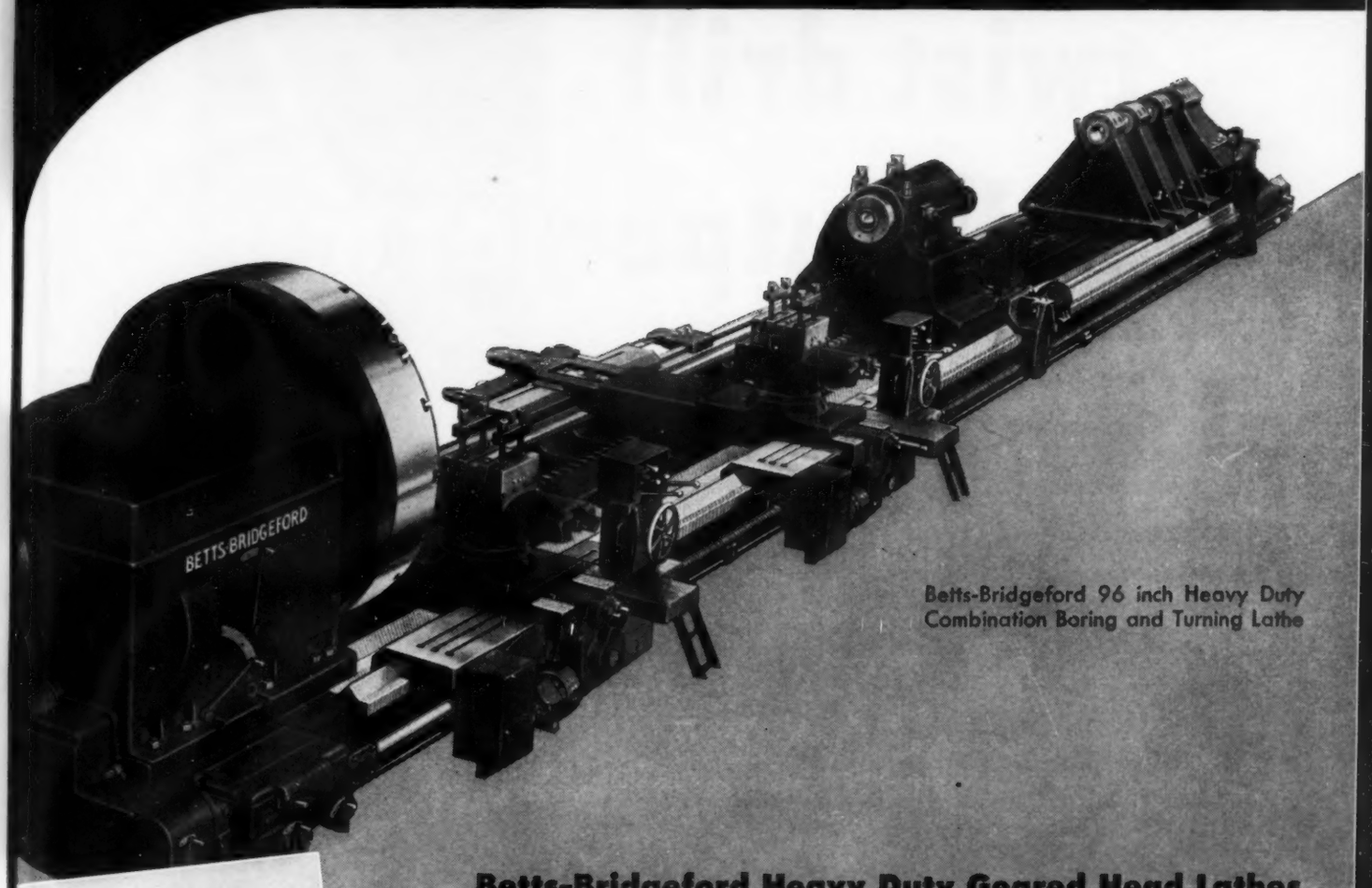
District Offices: NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

BETTS-BRIDGEFORD
Heavy Duty Geared Head
LATHES



Betts-Bridgeford 96 inch Heavy Duty Combination Boring and Turning Lathe

Betts-Bridgeford Heavy Duty Geared Head Lathes are built from 26 to 144 inch swing and larger

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

An earnest effort to produce the world's finest heavy duty machine tools has gone far to establish Consolidated's enviable reputation for designing and building heavy duty geared head lathes . . . a record of achievement extending back to the first Betts-Bridgeford Geared Head Lathe built in 1905. Today's Betts-Bridgeford Lathes have every advanced feature required for modern high production, accuracy and durability.

Full information covering any size Betts-Bridgeford Heavy Duty Lathe will be furnished upon request.

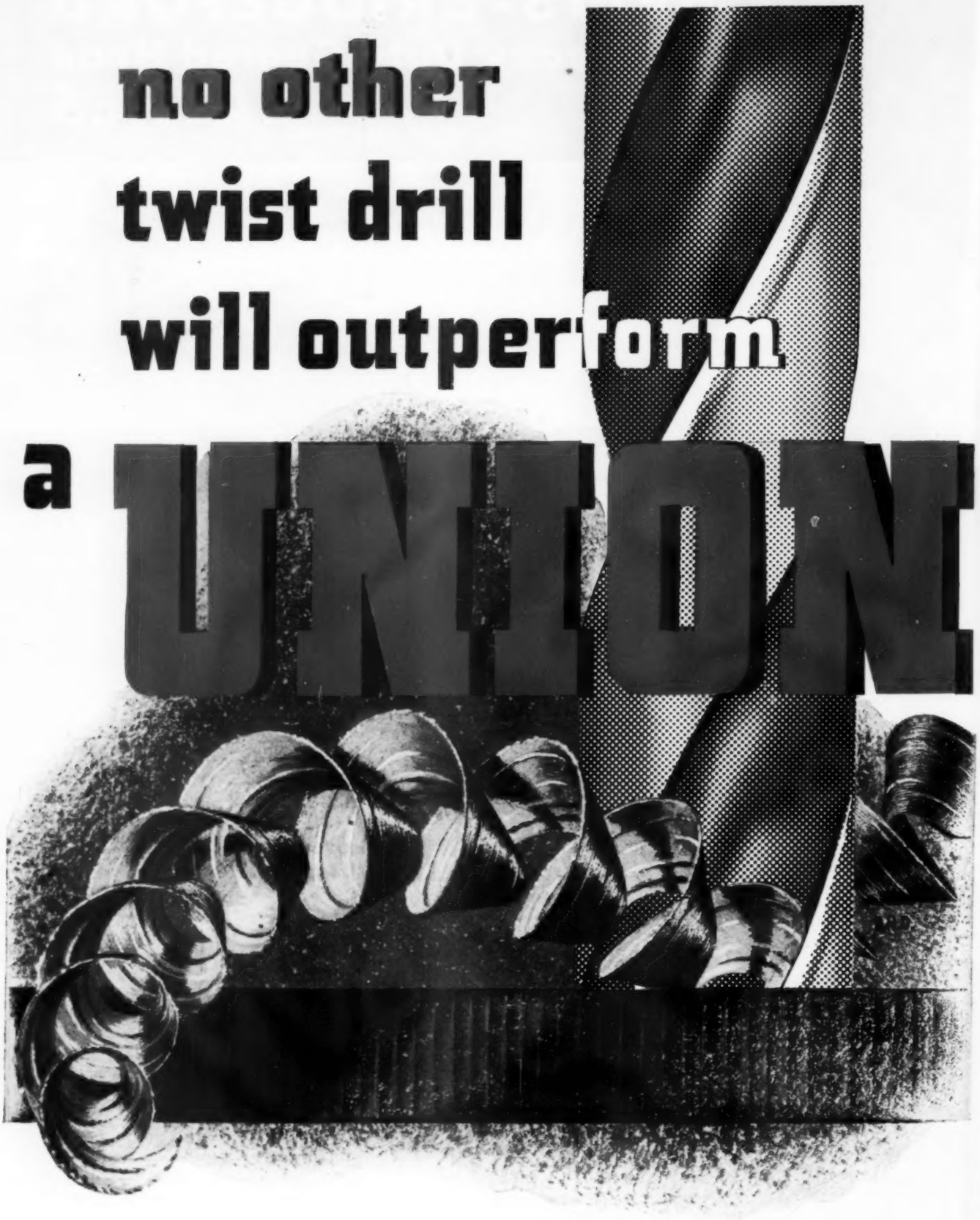
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

no other twist drill will outperform a UNION



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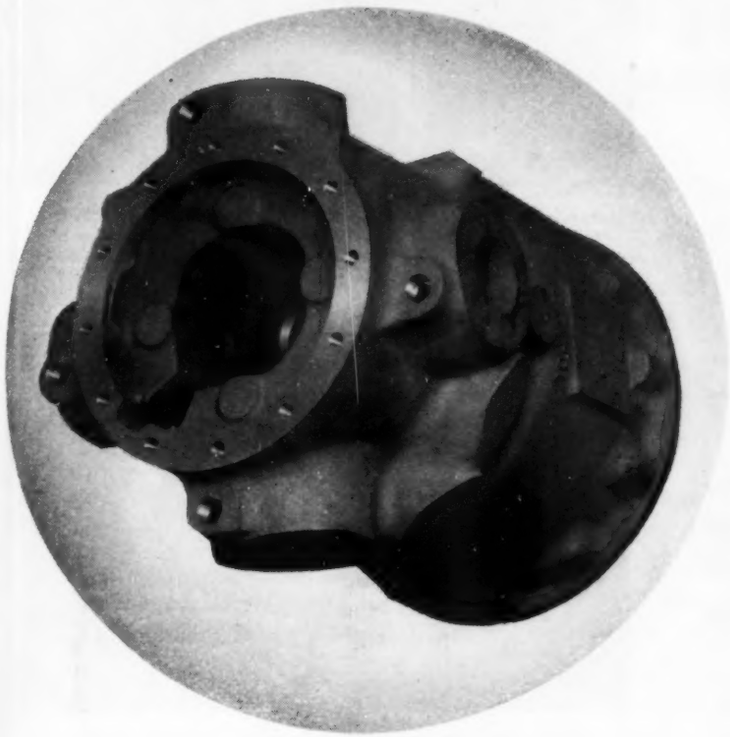
UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS
MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS
We own and operate S. W. CARD MANUFACTURING CO., Division, Mansfield, Mass.
BUTTERFIELD DIVISIONS, Derby Line, Vt., Rock Island, Quebec. Manufacturers of Taps, Dies, Screw Plates, Reamers.

One a minute-

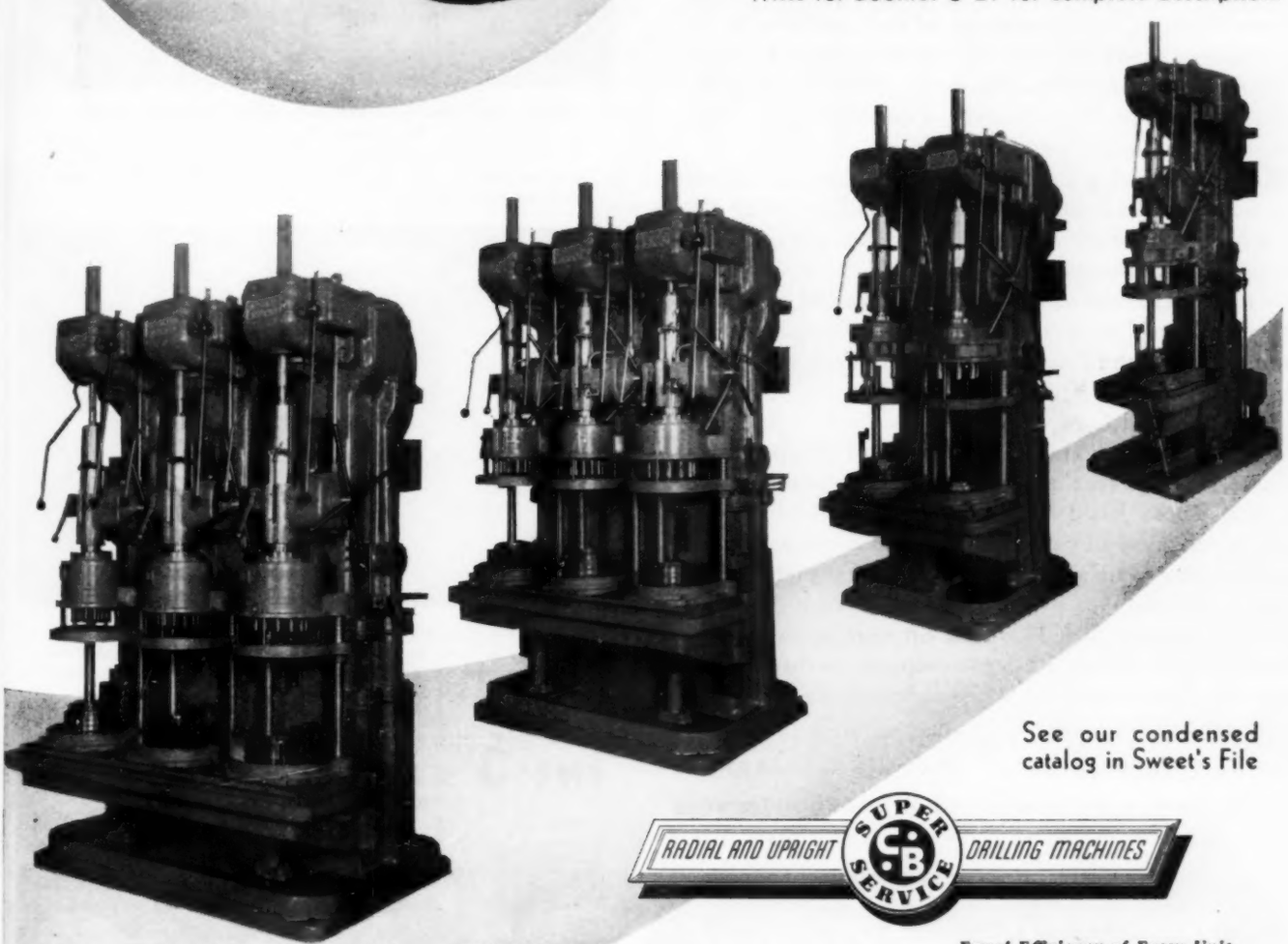


This battery of highly productive 21" and 24" Cincinnati Bickford Super Service Direct Drive Drills is drilling 24—.257" holes; tapping 24—$\frac{5}{16}$" holes; step drilling 4—$\frac{13}{32}$" x $\frac{7}{16}$" diameter holes $1\frac{5}{8}$" deep; tapping 4—$\frac{5}{8}$" holes in this crank case housing.

The operations are performed on both ends of three sizes of castings. All operations are completed at the rate of one a minute.

These Direct Drive Drilling Machines are made in the following sizes: 21" with 3 or 4 horsepower motor; 24" with 5 or $7\frac{1}{2}$ horsepower motor; 28" with $7\frac{1}{2}$ or 10 horsepower motor.

Write for Booklet U-27 for complete description.



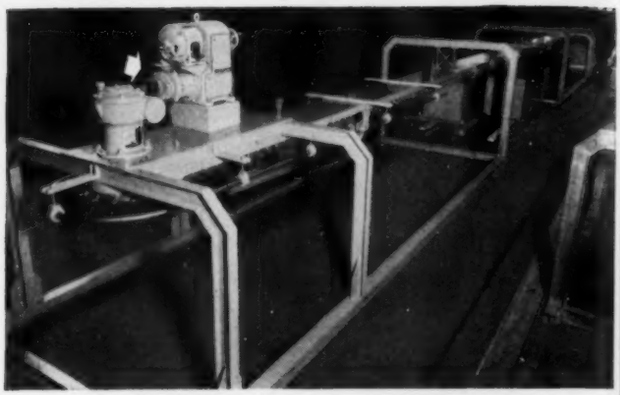
See our condensed catalog in Sweet's File

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9. Ohio U.S.A.**

New Ideas



Applied to this automatic conveyor for electroplating, REEVES Motodrive delivers any desired chain speed for any type of plating work being done . . . permits maximum production and uniform plating for a wide variety of products. Conveyor is manufactured by Lasalco, Inc., St. Louis.

...for speeding production, improving quality and cutting cost with REEVES Speed Control

The new ideas for increasing production efficiency, shown at right, are only three of thousands such improvements made possible by REEVES Speed Control.

Throughout industry—wherever there is need for variable speed control—REEVES opens the way to faster output, higher quality and lower cost.

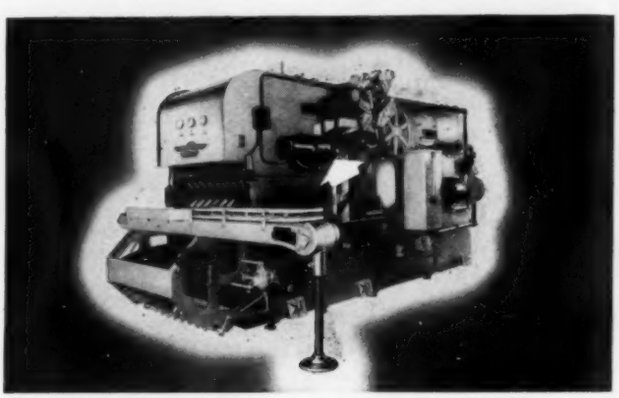
REEVES Variable Speed Drives provide any driven machine with instant, accurate speed adjustability . . . *deliver exactly the right speed for every operation and every operator, under every changing condition.* Stops and slowdowns are eliminated . . . waste of material and manpower are held to a minimum . . . and production is maintained at the fastest tempo consistent with high, uniform quality.

REEVES Speed Control is easily installed on machines already in service, and is now standard equipment on over 2,100 different makes of modern production machines. Three basic REEVES units are offered in the widest selection of designs, sizes, capacities and speed ratios—with manual, push-button or completely automatic controls.

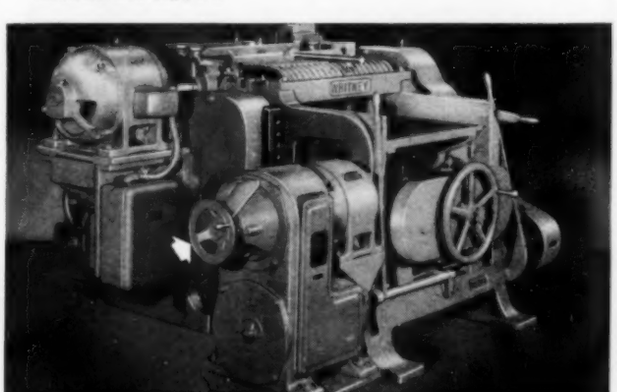
Install REEVES Speed Control on your machines now —and always specify REEVES-equipped machines when you buy new equipment. Write for comprehensive 114-page catalog A8-450A.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering



REEVES Vari-Speed Motor Pulley on this "Viking" Bottle Cleaner—manufactured by Barry-Wehmiller Machinery Co., St. Louis—provides exact cleaning time needed for different sizes of bottles, and synchronizes the cleaner with various other equipment, such as fillers and cappers.



On this Double Surface Wood Planer, manufactured by Baxter D. Whitney & Sons, Inc., Winchendon, Mass., a REEVES Motodrive regulates rate of feed to compensate for variances in hardness of the wood and depth of the cut.

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

SPOT NEWS OF METALWORKING

Renegotiation applies to defense contracts for machine tools and all other production equipment, including materials-handling units, awarded after May 21, 1948, if orders total in the aggregate more than $100,000 a year, according to ruling of Department of Defense. All contractors and subcontractors for aircraft units and components are subject to this renegotiation ruling.

Operator of many fleets of heavy vehicles has spent over $1 million in research work on a suitable steam power plant to replace internal combustion engines now in use. High cost of fuel is one of main reasons for this program.

Packard will make an outlay of over $5 million for new machinery and tools to produce its new automatic transmission. No date for introduction of transmission has been disclosed.

Downward trend in patent applications should be of concern to capital goods producers, declares William J. Kelly, president Machinery & Allied Products Institute. Among explanations for the decline: 1) standard of invention has risen, 2) adverse court decisions, 3) fewer applications from foreigners, 4) greater concentration of manufacture in big companies to whom patents are less important, 5) slow response from Patent Office.

Report from beyond the Urals in Russia: two new airplane engine plants cover almost a square mile, have 70,000 employees. The Kuznetsk region is manufacturing more ordnance than did all of Germany in 1943. Novo-Sibirsk in western Siberia has become a giant tank plant, its population growing to more than a million.

ECA had approved industrial equipment purchases totaling $22,600,000 up to July 1. Chief items: metalworking machinery, $2,800,000; construction and mining equipment, $4,800,000; machine tools, $800,000; general-purpose industrial equipment, $2,000,000; electrical apparatus, $3,000,000; and special industrial machinery, $1,200,000.

Elimination of steel's multiple basing point system will not be a handicap, state 49 stamping companies in replying to an inquiry from Pressed Metal Institute. Thirty-one firms take the opposite point of view, and four are uncertain.

A trickle of German machine tools, made in the U.S. zone, is reported flowing into this country. The flow may increase, say some observers.

Australian industrial expansion from now on is largely dependent upon U.S. dollars and U.S. equipment. Britain is unable to supply sufficient capital equipment or "cut in" the Commonwealth on the Marshall Plan.

Douglas Aircraft is producing 4000 fenders a week, along with other sheet metal parts, for automobiles. Company has announced it is branching out "into a wide variety of pressed metal products."

Skoda as well as other big Czech plants have turned almost entirely to production of armament for Russia. Exports to the west thus have declined sharply.

Gaging Metalworking

Industrial production, and that means metalworking too, appears likely to run on high, wide and handsome through the remainder of 1948.

New orders for all types of machinery, for one thing, are on the upgrade, after a drop of 6% in May and a whittling down of backlogs by a small amount. By prewar standards, the pile-up of orders still is tremendous. It is equal to about seven months' production, on the average.

Employment is believed hovering around the all-time high mark reached in June, with over 61 million people at work. That is a gain of 1.2 million over last year. Meantime, unemployment stays close to bedrock at 2 millions.

Capital Goods in Demand

Second-quarter earnings reports of big companies show that profits are well ahead of 1947. Demand for capital goods (new plant and equipment) thus should stay high; it may even be stronger during the last half than earlier in the year. The impact of defense business and ECA orders on top of this solid volume of business almost guarantees high-level activity for the rest of the year.

Crop reports are most encouraging. The grain crops promise to be of bumper proportions. The likelihood is that unless last-minute unfavorable developments occur, farm prices will come down later on. That would give a boost to meat production; and meat prices would drop in '49. The best thing that could happen for industry would be a decline in food prices. That would leave people more money to spend for other goods.

Effect of Wage Increases

Third-round wage increases will amount to about 8-10% for union labor. Non-union employees will get somewhat less. The overall wage rates in metalworking will rise about 6%. Higher labor costs will be felt in industrial prices. But the advances in many items will be considerably smaller than the much-publicized boosts in steel and automobiles. All in all, this year will see a price increase of around 5%.

Vacuum Cleaners a Case Study

Vacuum cleaners provide a case study of what happens when an industry runs into a buyer's market. Last year the industry turned out 3.7 million floor-type cleaners, enough to catch up with the backlog of consumer demand. This year the going is definitely rougher. Competitive selling is back with a vengeance. Yet production is still moving along at a rate of more than 3 million a year, or double the 1941 total. So the shift to a buyer's market, while painful, was something less than the calamity that some people had predicted.

Welding Equipment Sought

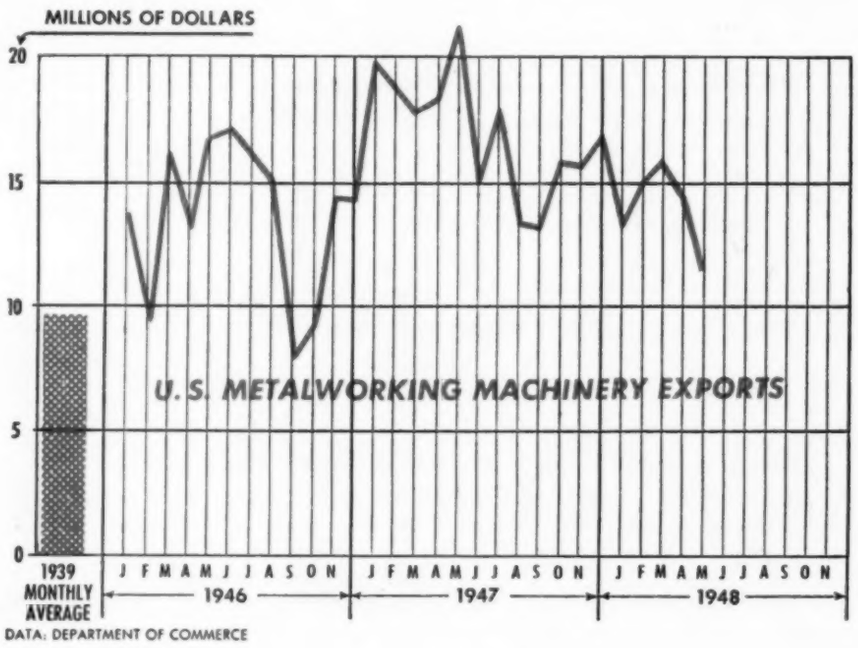
Demand for resistance welding equipment is reaching unprecedented proportions. New orders received during April, May and June were 22% ahead of shipments for the entire year of 1938 and 13% above orders for the first quarter of 1948.

This mass production equipment, comprising spot, projection, seam and flash welders, is sought by manufacturers now in the process of redesigning products for faster production at reduced costs.

Copper Prices Boosted

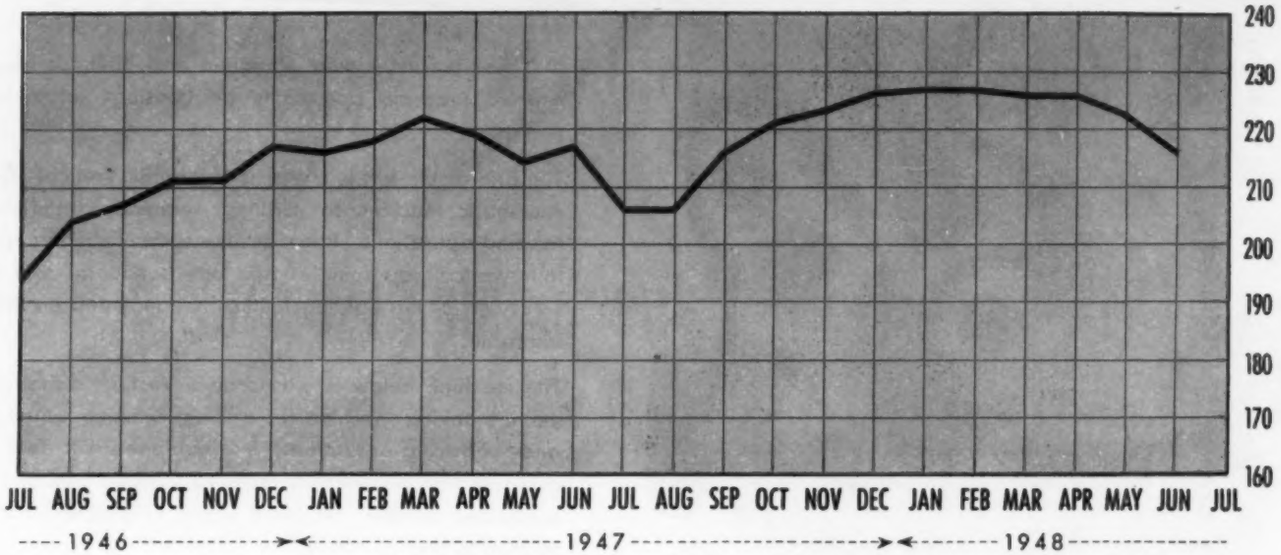
Another increase in prices of fabricated copper goods has already started in the face of a recent boost in copper prices which followed closely on the heels of advances in zinc, nickel and lead. This is the second rise in fabricated materials; the first came last month when the mills

MONTH		MILLIONS OF DOLLARS
1948	JANUARY	13.4
	FEBRUARY	15.0
	MARCH	16.0
	APRIL	14.4
	MAY	11.7



DATA: DEPARTMENT OF COMMERCE

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX	COMPONENTS				
	MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
JUNE 1948..... 216	250	227	217	282	148
MAY 1948..... 222	251	229	225	289	144
JUNE 1947..... 217	229	232	218	305	147

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1 Index figures are a percentage of 1939, which equals 100.

boosted prices as a result of wage increases.

The copper increase came at a time when fabricators were enjoying an increase in business above the normal seasonal amount. The spurt in business is attributed to anticipation on the part of manufacturers of the second boost, even at the cost of sharply rising inventories.

One large non-ferrous metal producer explained the higher trend in the market as the result of the heavy drain since the war on ore reserves which has caused refinement of lower-grade ore bodies with a subsequent upward surge in production costs as well as in labor and supplies.

Lead advanced to 19½ from 17½ cents, New York; zinc jumped to 15 cents, East St. Louis, up 3 cents, and nickel spurted up 6¼ cents, fob Port Colborne, Ontario, to 40 cents. One copper advance was 2 cents to 23½ cents but at this writing major producers had not announced increases.

Consumption of copper by fabricators in June showed an increase over May of almost 7,000 tons.

Gear Orders Up in June

The gear industry showed an increase in the June volume of business over May of 14.28%, on the basis of the new index figure of 1935-39=100. The index is computed at 324.1 for June.

Stainless Steel Volume Up

Output of stainless steel in 1947 totalled 520,000 tons and all indications lead to the belief that the use of stainless and heat resisting steels in 1948 will top this figure by a considerable amount.

▸ The increasing use of these metals is shown by the fact that nine years ago the production only hit 180,000 tons. Finished products of these metals in 1947 totalled 333,000 tons, which set a new record.

▸ Chromium-nickel stainless steels and special high-nickel alloys are being used for turbine blades, nozzle vanes and other vital parts in jet-propelled aircraft and turbine engines.

Foundry Labor Scarce

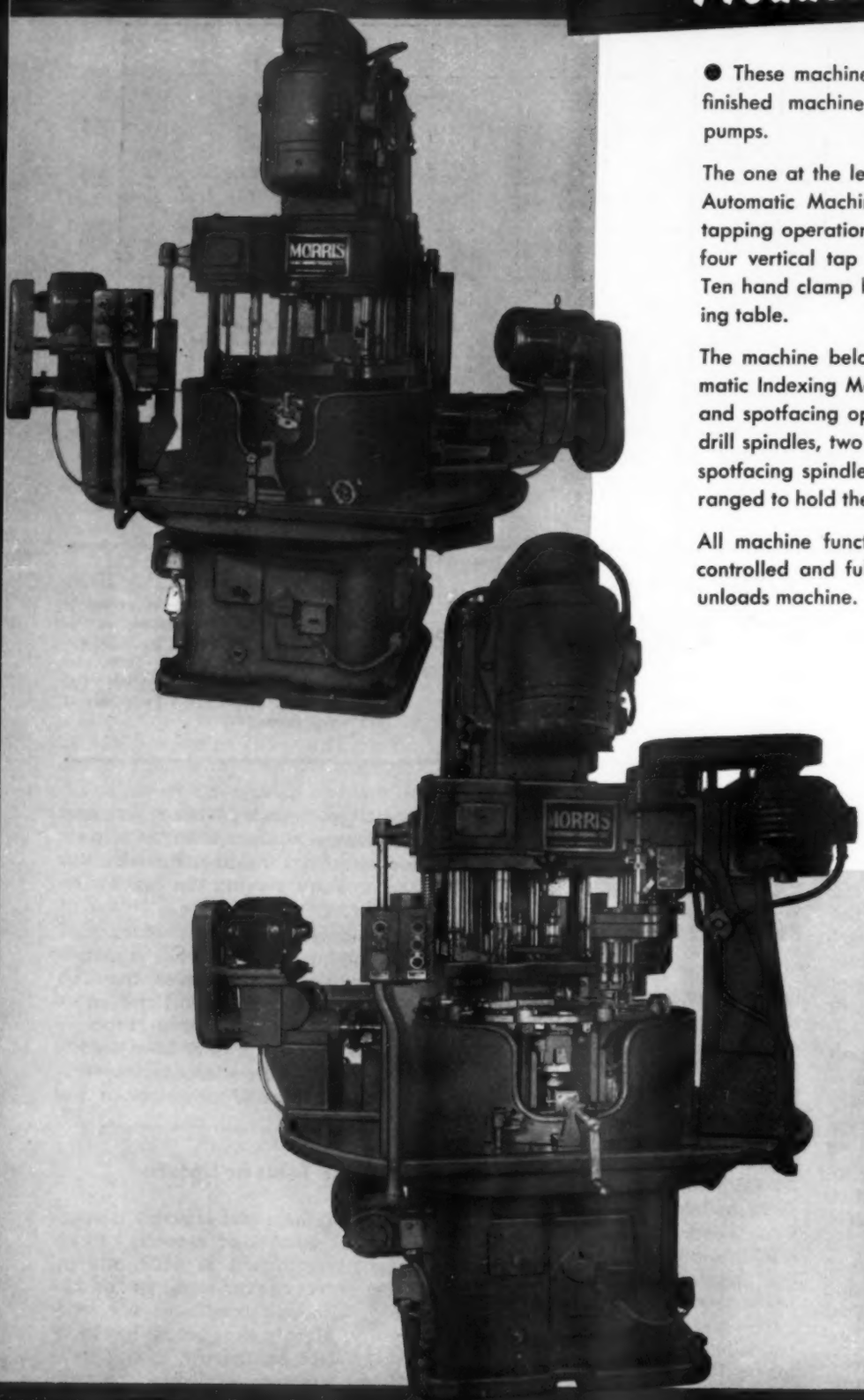
Foundries in heavy industrial areas are finding the labor market very tight. As a measure to attract high school graduates and boys attending trade schools, the Muskegon, Mich., high schools are installing the latest-type foundry labor-saving and mechanical equipment in the schools for vocational training. Foundries in the area are bearing the cost of the project.

▸ Supply of pig iron is still scarce and the quality of the coke is mixed. Meanwhile, it is believed that fob mill prices on steel will not affect directly sales of gray iron foundries as these suppliers have been on fob foundry basis for years. However, it will affect some of the prices on raw materials.

Machine Tools on Upturn

The machine tool industry is operating at 50-55% of capacity, which now is estimated at $608 million. New orders appear to be on the upturn, although conditions are very spotty. Hardly ever before has business varied so sharply among individual companies. Some, particularly those selling special-purpose or semi-special machines, are much busier than others. The majority of companies have an order backlog of better than three months, based on current operations. The cycle of manufacture of most types of machine tools is three to four months.

PULLING FOR HIGH PRODUCTION— MORRIS MOR-SPEED *Production Machines*



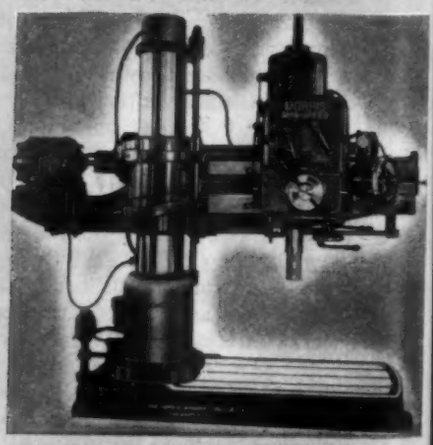
● These machines were designed and built for rough and finished machine operations on housings for automobile pumps.

The one at the left is a Morris Hydraulic Vertical 10-Station Automatic Machine for drilling, reaming, chamfering and tapping operations. It has twelve vertical drilling spindles—four vertical tap spindles and one horizontal drill spindle. Ten hand clamp holding fixtures are mounted on the indexing table.

The machine below is a Hydraulic Vertical 6-Station Automatic Indexing Machine for drilling, reaming, counterboring and spotfacing operations. It is equipped with four vertical drill spindles, two vertical reaming spindles and one vertical spotfacing spindle. Six hand clamp holding fixtures are arranged to hold the work.

All machine functions on both machines are hydraulically controlled and fully automatic—operator merely loads and unloads machine.

When your work requires multiple operations and high productivity consult Morris they have the experience—engineering "know how"—and facilities to design—develop—and build high speed production equipment to meet your specific need. Write for details.



MORRIS MOR-SPEED RADIAL

Builders of MOR-SPEED *Line*

The MORRIS *Machine Tool Co.*

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

A Sound Replacement Policy Pays Off

Few problems of management are handled so haphazardly as machinery replacement policies. Yet an adequate replacement program can spell the difference between success and failure, between profit and loss.

Pitifully few metalworking companies have any replacement formula at all. If you doubt that statement, go out and ask a number of firms, "Do you have a production equipment replacement policy?" You will be amazed at the large percentage of negative replies.

Some companies have a rule-of-thumb formula. But often it is not adhered to; and no one in authority tries to enforce it.

A surprising array of important manufacturers have a rule at the top which apparently the men farther down the line have not heard about. The president tells you one story, the master mechanic something else.

These facts confirm the conclusion that the production equipment replacement program too often gets buried under a lot of other programs on management's desk. About all that it does is to accumulate dust.

Fortunately, the metalworking industry has in its ranks some far-seeing executives who recognize what a sound replacement policy means to their business.

In these days of high cost of production, listen to James R. Weaver, works manager of Westinghouse at its East Springfield, Mass., plant:

"A good replacement plan will show up machines not operating efficiently. Further analysis in most cases will show that these inefficient machines can be replaced with new equipment to make additional savings possible."

Mr. Weaver is not applying a replacement policy at Westinghouse for fun. He is doing it because he knows that it pays off in cold, hard cash. The company earns more profits.

And that leads to the recent statement of General Motors president Charles E. Wilson. He points out that better tools and machinery with which to make the product are essentials of efficient production.

To reinforce the point: we cite the survey of the National Industrial Conference Board on productivity of workers. The survey reveals that physical output per manhour now exceeds that of a year ago in more than two-thirds of the companies sampled. Slightly more than three-fifths of the companies reported greater productivity than prewar.

Though many factors contributed to the higher level of productivity, "improved equipment and tools" was the one most frequently mentioned.

Unless today's unprecedented wage rates are to inundate and destroy industry's earning powers, metalworking companies must get greater output per manhour.

What better way is there to secure this intensified productivity than by installation of new production equipment? That is so by testimony of industry itself in answering the Industrial Conference Board's questionnaire.

And what better way is there to have a continuous policy of installing new equipment than to adopt and put into operation an intelligent machinery replacement program?

Burnham Finney

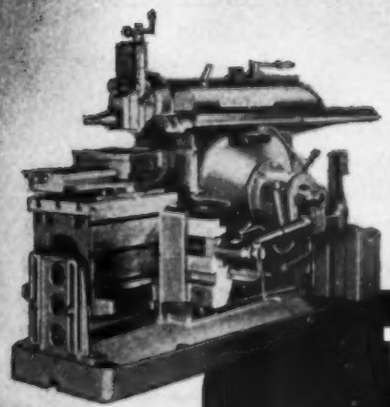
EDITOR

INTERNAL SHAPING...

In the field of internal shaping alone, Cincinnati Shapers are used on a long list of "hard to get at jobs"—from cutting internal key ways to cutting symmetrical and non-symmetrical holes.

We show a Cincinnati Shaper shaping internal key ways in a blind hole—a "hard to get at job." Remember, a Cincinnati Shaper, the tool of many uses, will always be busy in your shop.

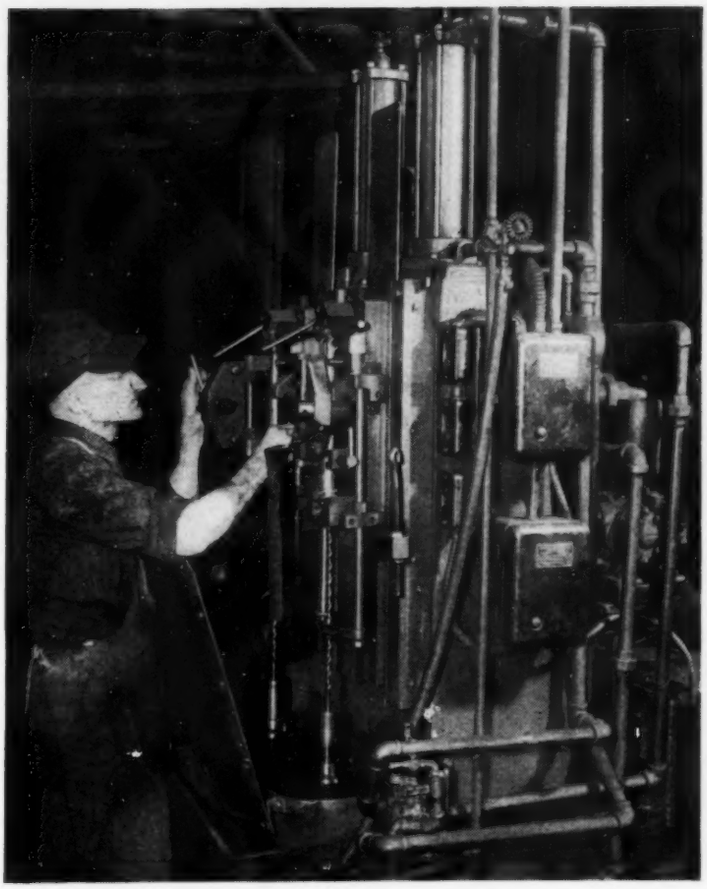
Write for Catalog N-2, describing these powerful accurate Shapers.

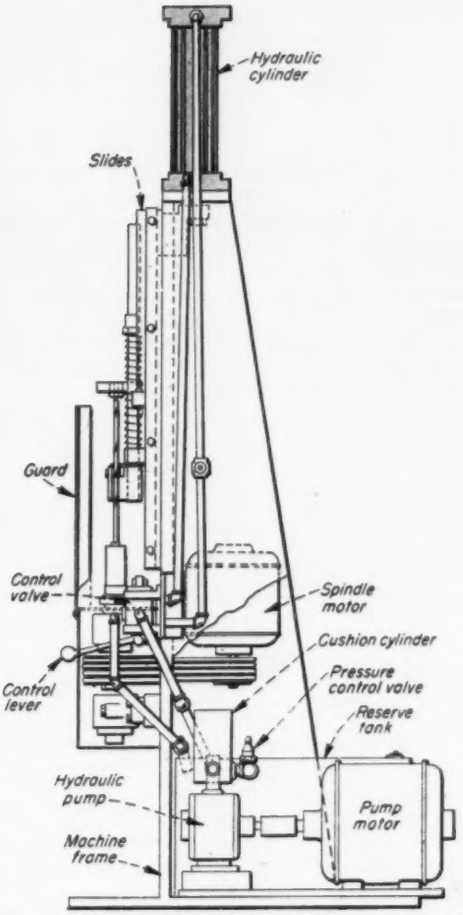


THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES





SPECIAL DEEP-HOLE DRILLING MACHINE has two spindles inverted for chip clearance in drilling a ⅝-in. hole 12 in. deep in cast iron. Mounted on vertical slides the work is fed down against the drills by hydraulic cylinders. Slides can move alternately, with piece being loaded onto one while drilling is being done on the other. Side view shows arrangement of hydraulic components and spindle drive. Oil supplied to cylinders is at 150 psi.

HYDRAULIC UNITS POWER MACHINE ELEMENTS

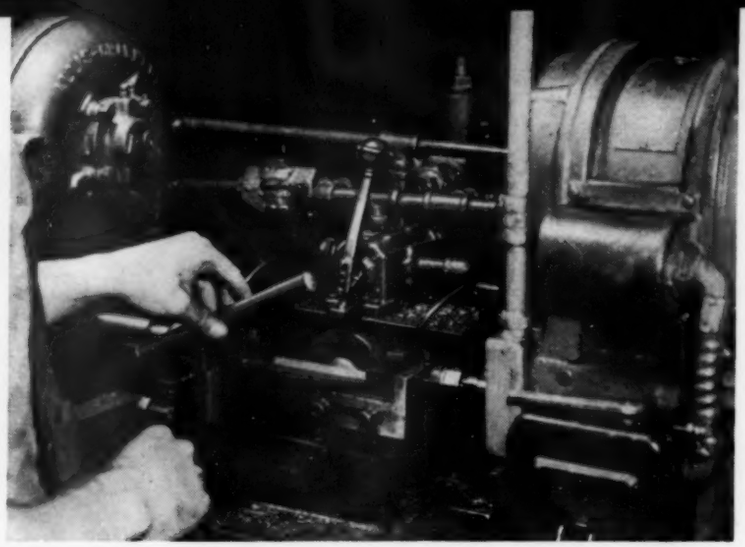
BY L. W. COURT, WORKS ENGINEER, RICHMOND WORKS, FARM IMPLEMENT DIVISION, INTERNATIONAL HARVESTER COMPANY

HYDRAULIC power has been applied successfully not only in modernizing old equipment but also in building special machines for our manufacturing operations at the Richmond Works.

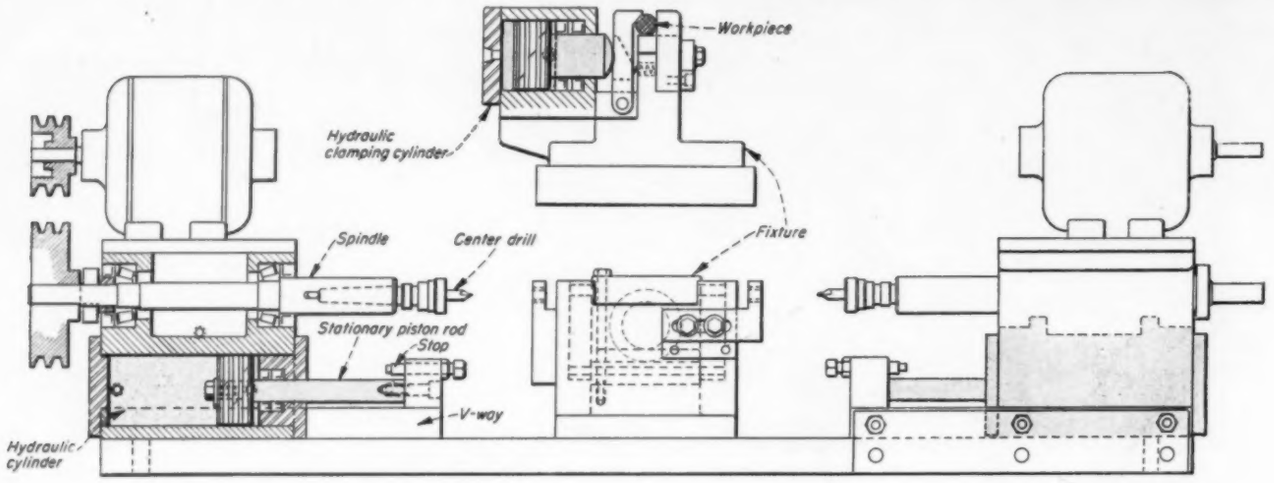
Usually we assemble our own power units from purchased parts, but we have constructed cylinders and valves for a few special jobs. Where possible, the pumps with their drive motors, valves and sump tanks are mounted outside the machine to simplify maintenance of these units. For the same reason piping also is out in the open.

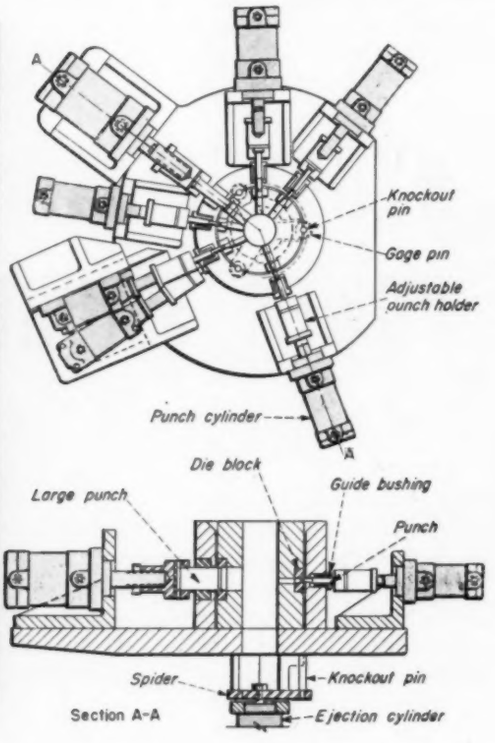
We prefer low-pressure systems, and use them wherever there is space to mount a low-pressure cylinder large enough for the load. Pressures normally range from 200 to 500 psi., and rarely go above 600 psi. Hydraulic circuits usually are arranged for an automatic machining cycle.

We use pneumatic cylinders to some extent, although pressures in our shop air line vary so much that the proper functioning of machine elements cannot always be guaranteed. We find that hydraulic circuits with individual motor-driven pumps and reserve tanks offer many advantages. One of our applications is shown above; several others are illustrated and described in the three pages that follow.



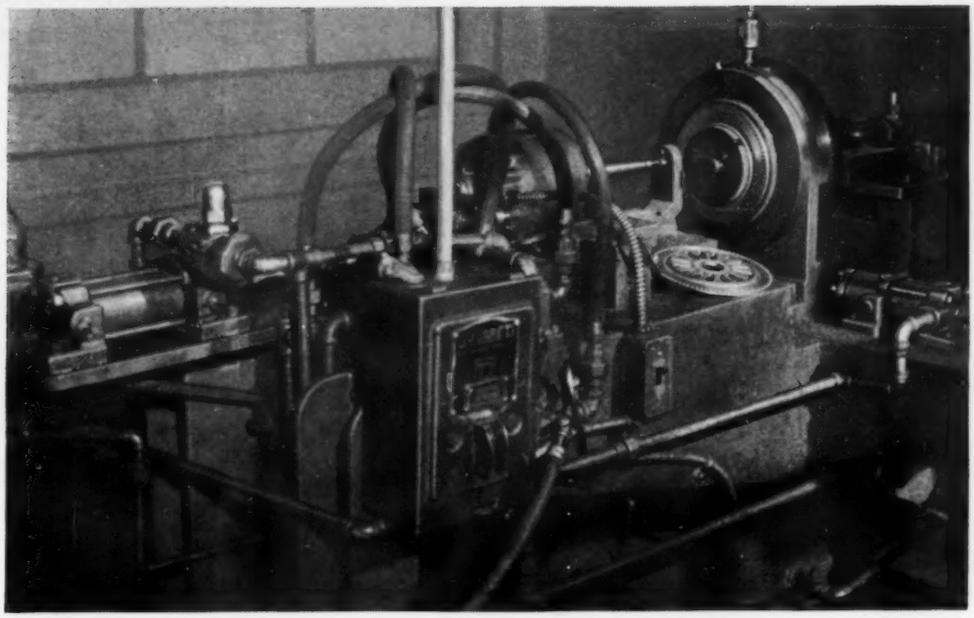
SPECIAL CENTER-DRILLING MACHINE centers both ends of 25/32-in. pinion shaft simultaneously. One control lever above fixture actuates three hydraulic cylinders that clamp workpiece and advance drillheads. Fixture is adjustable for pieces 8⅛ to 8½ in. long. Sliding heads are moved by cylinders integral with housings, detailed below. Advance of each head is limited by an adjustable stop, and drop-in pin acts as stop for return travel

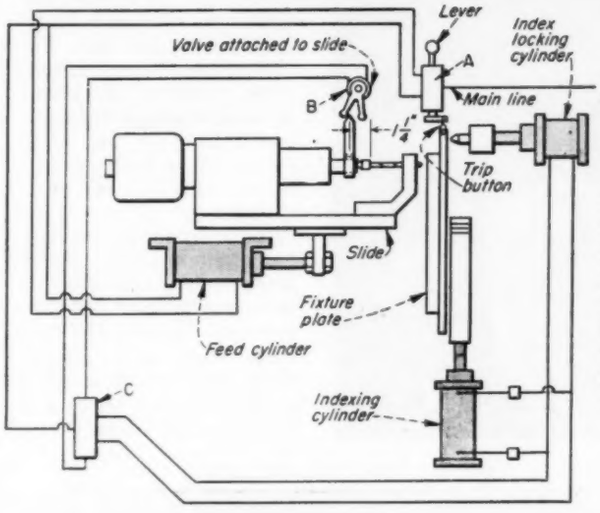




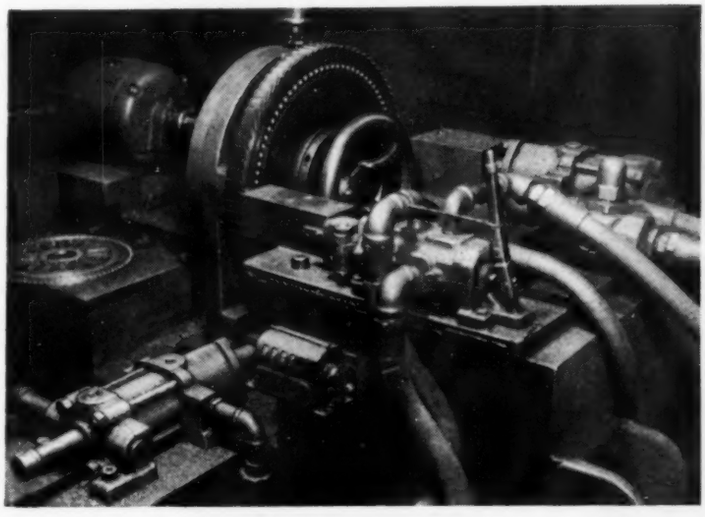
PUNCHING MACHINE pierces seven holes of different sizes in can section of 0.035-in. sheet steel. Operator presses pushbutton to actuate solenoid valve controlling hydraulic cylinder under machine. Cylinder moves rack to rotate camshaft operating three hydraulic valves. One controls a large hydraulic cylinder for the largest punch; the other two control three cylinders each. 5-hp. motor drives pump rated at 8 gallons per minute

AUTOMATIC INDEXING and DRILLING MACHINE

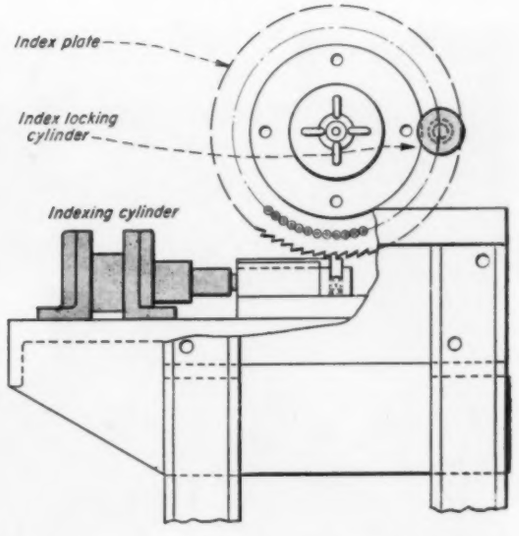




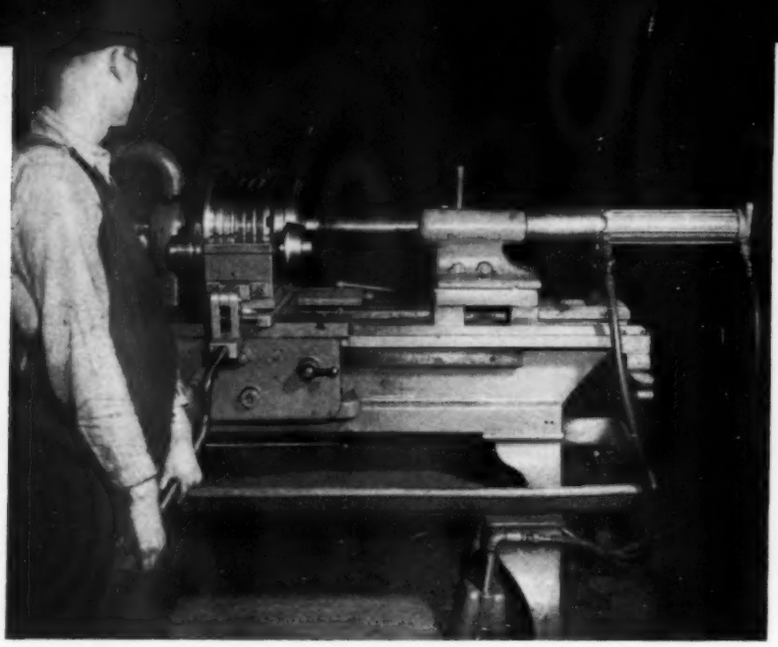
HORIZONTAL-SPINDLE DRILLING UNIT machines holes in the periphery of two cast-iron seed plates at a time. Except for electric-motor-driven spindle, all motions are supplied by three hydraulic cylinders. One moves the drillhead, another turns the index wheel, and a third locks the index wheel in each position. Schematic at left shows the hydraulic control system. Pushing the lever on valve *A* causes drill slide to advance; this starts drill motor. Lever is held until one hole has been drilled and fixture has indexed to next hole, allowing valve *A* to latch in applied position. Valve *B* then controls the machine through valve *C* and operation is automatic until all holes have been drilled. Then valve *A* is unlatched by a pointed pin that is pushed by spring-pressure into a countersunk hole on back face of index wheel (sketch differs in this detail)



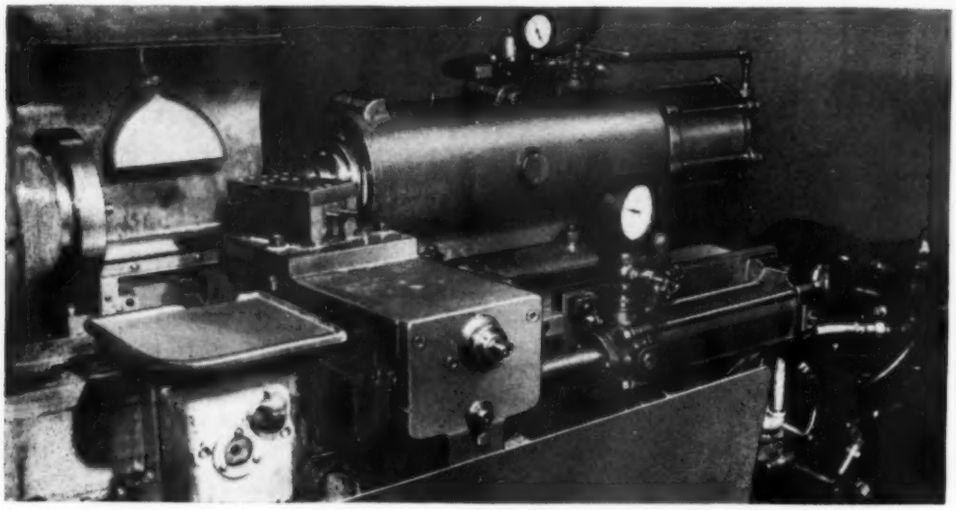
INDEX WHEEL of drilling machine and drill bushings are interchangeable because number of holes and drill size varies with different seed plates. Flexible hose lines connect some valves and cylinders to permit adjustment for different index wheels. Indexing cylinder, sketch, pushes slide forward to turn index wheel one notch.



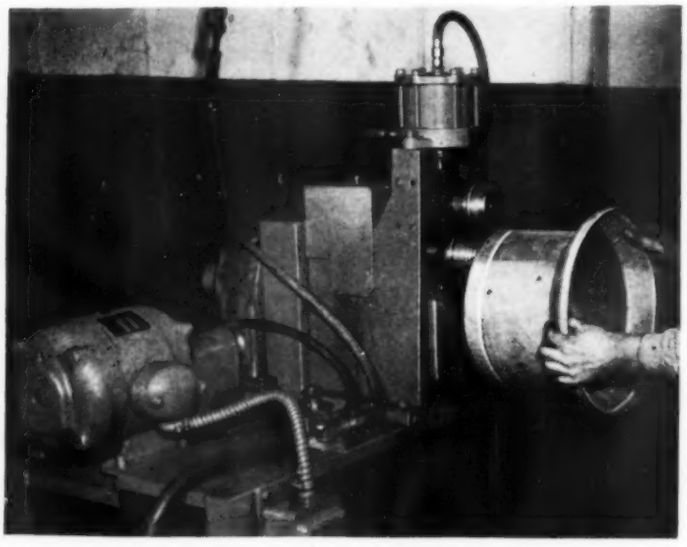
Spring-loaded plunger in slide engages teeth in index wheel. Tapered pin on end of piston of locking cylinder is forced into countersunk holes on back of wheel to lock wheel in each position. This locking pin must be withdrawn to leave the index wheel free to rotate before the indexing cylinder can operate

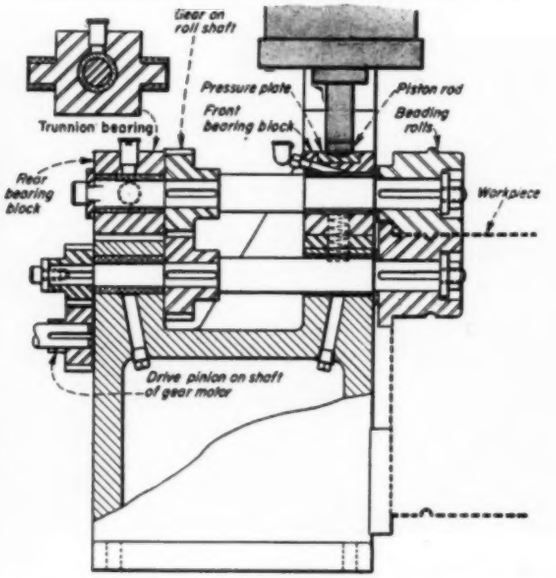


TRIMMING LATHE for fertilizer-can sections has tailstock equipped with double-acting air cylinder controlled by foot valve under machine. To minimize operator fatigue, an air cylinder will eventually replace hand lever for moving the cross-slide that carries the trimming rolls

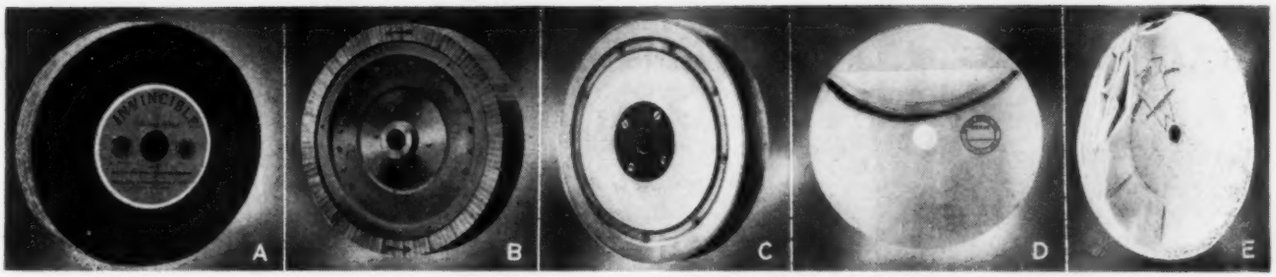


CARBIDE - TURNING operation with two tools is done at 630 fpm. on standard Sundstrand lathe equipped with 15-hp. motor and revised for hydraulic feed and tool relief. At end of turning stroke reversal of feed cylinder actuates second cylinder under cross-slide to withdraw tools from work while carriage is returned to start. 600 psi. pressure is provided for longitudinal traverse. Shop line furnishes power for air cylinder operating tailstock spindle





BEADING MACHINE for fertilizer-can sections has air cylinder to hold beading rolls together after part has been inserted against gage plate. Double-acting cylinder operates from shop air line against tool steel pressure plate in upper-roll assembly and is controlled by foot valve. Rolls are driven by 1-hp. motor through reduction gearbox at rear of machine. Upper shaft, above, is held up by springs until rolls are closed by air cylinder. Rear bearing-block is mounted in trunnions to permit shaft to swing up when pressure is released



(Photos courtesy Hudson-Van Winkle-Munning Co. and Divine Bros. Co.)

POLISHING WHEELS differ in material and construction. Those shown are, **A,** woven cotton fabric wheel of spirally sewed sections; **B,** compress leather cushion wheel (cushions also may be of felt, walrus or sheepskin); **C,** leather-covered wood wheel; **D,** loose-sewed buff; **E,** buff of folded construction

What to Watch in Metal-Polishing Costs

Proper application of wheel, abrasive, adhesive and method of wheel set-up is essential to low-cost polishing

BY E. C. BLEAM
ABRASIVE ENGINEER, SIMONDS ABRASIVE COMPANY

DESPITE automatic machines and labor-saving devices, polishing costs can vary from day to day and even from job to job. Largely responsible for such a condition are wrong materials and wrong or unstandardized wheel setup.

Selection of materials for polishing wheels and the methods of setting them up should not be governed by tradition, rule of thumb, or personal opinion. Such important cost factors should be based only on facts—facts developed from scientific tests to provide data on wheel life, production rate and surface quality produced. Once determined, materials and methods should be standardized.

While exact requirements for specific jobs can best be determined by tests under actual shop conditions, on machines that will be used in production, and on the actual parts polished, it is not necessary to test all available polishing materials and setup. Basic qualities of wheel, abrasive, and adhesive have been standardized and serve as a guide in narrowing the number of varieties that must be tested. Likewise, considerable information is available on setup methods.

Although most polishing wheels are made of woven cotton cloth, wheels of sheepskin, felt, walrus hide and leather-covered wood are preferable for some kinds of work. Slight differences in construction (even between wheels of the same material) may make considerable difference in performance.

In general, wheels of woven cotton fabric are for polishing iron, steel, bronze, brass and aluminum. The fabrics are sewed together into sections that are glued or cemented together to give a wheel of the required thickness. Wheels of similar construction, but of canvas belting, are for roughing out cast iron and steel.

Heavy castings of brass, copper, aluminum and non-ferrous alloys are best polished with less-dense canvas wheels. The material is the same, but the construction is different in that the disks are cemented together with special rubber cement instead of glue.

Wheels of extra flexibility are desirable for irregular-shaped castings and for thin, springy strips and stampings that are likely to cause chatter when polished with denser wheels. Wheels made of ⅛-in. thick disks, quilted together, are recommended. Still-less-dense wheels are made by cementing together disks or sections of soft sheepskin.

Walrus hide is for fine finishing on such products as firearms, cutlery, silverware and parts of brass and high-grade carbon steel. Although walrus hide is tough, it is also very resilient. Walrus-hide wheels are economical for grease-wheel polishing because they can be cleaned of grease and oil by mere soaking in gasoline, and are ready for setting up again as soon as they are dry.

Wool-felt wheels have cushioning qualities that no other polishing wheels possess, and so find wide application, although their special field is in dry fining and grease-wheel work. These wheels can be had in a variety of densities, and their faces can easily be shaped to fit irregular surfaces. Although high in first cost, felt wheels are economical when prop-

GLUE BRUSHING should be performed on a wheel that has been preheated to avoid sudden cooling and too rapid jelling of the glue

PROPORTIONS of GLUE and WATER

Grain size	% Glue	% Water
24-36*	50	50
24-36**	47	53
46-54	45	55
60-70	40	60
80-90	35	65
100-120	33	67
150-180	30	70
220-240	25	75

*Severe work
**Plain surfaces, round corners

erly set up and correctly applied.

Flat work such as cutlery is polished to best advantage with a wheel that has a solid core covered with a thin cushion. Wheels of white poplar covered with heavy oak-tanned back leather are common. The wheel face is square and will not gouge the work.

ABRASIVE

Abrasives for various materials and operations are aluminum oxide, silicon carbide, corundum, emery, pumice, rouge, chromium oxide, unfused aluminum oxide, quartz, tripoli, lime, diatomaceous earth, rottenstone, chalk and colloidal clay.

Probably 90% of all metal polishing is done with aluminum oxide, of special shape and treatment. Grains can be altered in manufacture to meet various polishing requirements.

It is important that abrasive grains be uniform in size, otherwise large grains will scratch the surface, while small grains will not do their share of cutting, with consequent loss of production. Fast cutting depends to considerable extent upon the grains being solid, uniformly sharp, and free from flats and slivers.

Several materials commonly polished and the size of grain normally selected for each operation are shown in an accompanying table. Some shops are able to specify grain sizes that are one or two sizes smaller than those shown because parts are received by the polishing room with better surfaces than usual. This results from improvement of molds, dies and rolls. It pays to consider this possibility when standardizing on grain sizes, as it may be possible to reduce polishing time greatly and even to eliminate some operations entirely.

Even the best suited materials, however, will not give proper performance unless they are put together properly into wheels. Failure of the wheel setup room to do that is probably the most common cause of low production, high cost, and poor quality.

WHEEL SETUP

The setup and drying rooms should be entirely separate for best results. Excess moisture in the setup rooms reduces the capillarity of the abrasive grains and as a result they can not absorb the required amount of glue. This means poor adhesion to the wheelhead and rapid wheel wear. Room temperature should be held around 80 F. to avoid too rapid jelling of glue. Such jelling reduces its adhesive properties, prevents abrasive from penetrating the glue readily and so keeps the grain from packing well on the head. The result is an excessive proportion of glue to abrasive and a wheel that runs hot and cuts slowly.

There are several ways to prepare glue, all of which have advocates. All, however, agree that only a few hours' supply should be prepared at a time, for glue that is kept more than three or four hours decreases in strength.

The proportion of glue to water depends chiefly upon the size of the abrasive and to some extent upon the nature of the polishing operation. Data in the table can be used as a guide. The proportions given are by weight.

Most old-timers soak glue in cold water for several hours before heating it; some soak only one hour; others save all of the soaking time, and put the glue and water on to cook at the start. These latter claim to get satisfactory results by bringing the water to 165 F., stirring in the glue until it is melted, and then at once reducing the temperature to 140 F. Reducing the temperature promptly and sufficiently is important because the higher temperature will weaken the glue's adhesive strength excessively. For this reason glue pots should be equipped with a thermostatic control device.

Glue pots and brushes should be cleaned daily with hot water to remove all remaining glue. Glue, in a short time, becomes infected with bacteria, and when infected, will not do a satisfactory job. Separate glue pots are needed for each size grain to prevent different sizes being mixed by transferring through the brushes.

The face of a new wheel is prepared for the glue and abrasive by truing in a lathe. The lap so laid back determines the direction of rotation of the wheel when it is

HEAD FORMING is performed by rolling the glued wheel through heated grains in a metal trough. Density of head varies with pressure exerted

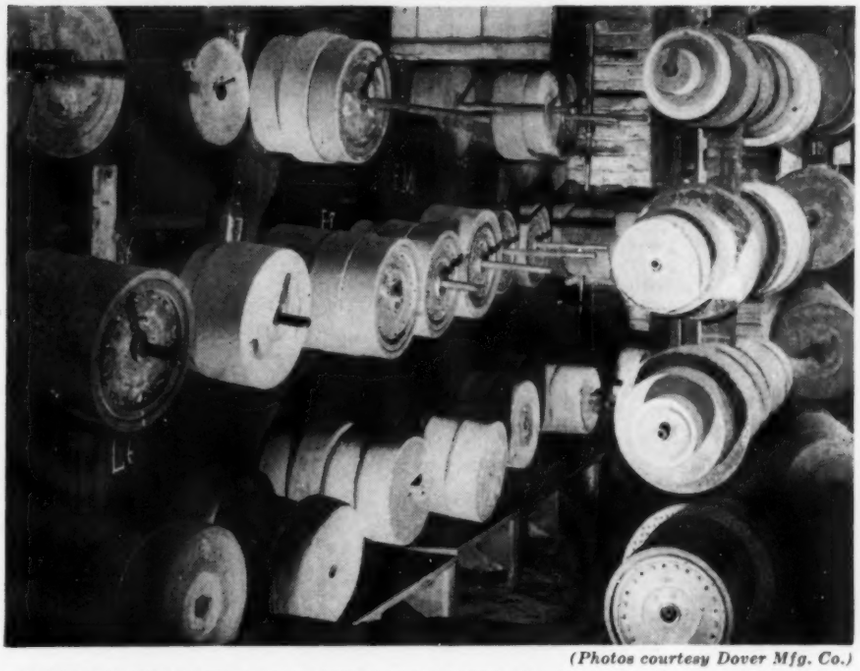
coated with glue and when it is polishing.

A new wheel is sized with glue both on the face and for a distance down the sides to prevent absorption of moisture. This priming coat is impregnated with fine grain to provide a head on which the working head will be superimposed. It is partially dried, then the final coat is applied.

Ordinarily, a used wheel is prepared by removing the old head with an abrasive brick. If deeply pitted, the old glue is removed by thorough soaking with hot water, if the wheel is of fabric. To prevent the damage that water will do to leather and wood wheels, they are cleaned dry with abrasive bricks. Gasoline is used for removing all oil or grease from wheels that have been used with those substances.

Glue should be brushed on the wheel at 135-140 F. At this temperature, glue is strongest. To prevent the temperature of the glue from falling to the jelling point when it comes in contact with the cooler wheel and abrasive grain, both wheel and grain should be heated to about 120 F. It is poor practice to try to avoid preheating the wheel and grain by applying glue at a higher temperature, say 160 F.

Next the wheel is rolled in the abrasive, which is heated in a metal trough. The character of face produced and its consequent polishing action depends upon the pressure exerted on the wheel while picking up the grain. A light pressure will give a thinner and more open head, while a denser head will result from heavier pressure. Once the character of head for any job has been determined, care should be taken that wheels for that purpose are subjected to the pressure that produces such a head. Variation in pressure from wheel to wheel often causes lack of uniformity in wheel action.



(Photos courtesy Dover Mfg. Co.)

DRYING ROOM for wheels should enable control of temperature and humidity. Correct drying conditions are essential to proper wheel performance

WHEEL DRYING

Unstandardized and uncontrolled drying is probably the greatest cause of varying performance of polishing wheels. This is true whether the adhesive used is glue or cement.

An over-dried wheel has a short life, the grains being torn out while still sharp. If under-dried, the glue does not achieve proper strength, the wheel cuts slowly, and pieces of the face may fly off in use. For maximum strength, the wheel should dry slowly until the moisture content of the glue is 10 to 12%.

Numerous tests have shown that the most satisfactory results come when the temperature of the drying room is from 80 to 90 F., with 50% relative humidity. However, other combinations seem to have worked satisfactorily in some shops, for example, 75 F. with 45% humidity and 90 F. with 55% humidity.

The time of drying can be reduced with no bad effect on the wheels by increasing the rate of air circulation. Many rooms have no air circulation, but all would benefit from it.

It pays to bear in mind that, from the cost viewpoint, few metalworking operations are as responsive to study and standardization as polishing.

GRAIN SIZE RECOMMENDATIONS

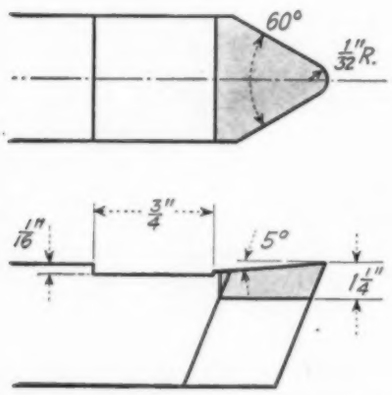
MATERIAL	POLISHING OPERATION				
	First	Second	Third	Fourth	Fifth
Aluminum, sand-cast; inside	36-46				
outside	60-80	120-180	buff		
Aluminum, die-cast	150*	buff			
Aluminum, sheet	120*	180*	buff		
Brass, sand-cast	60-80*	150-180*	220-3F*		
Brass, sheet	180-220*	buff			
Gray iron, not pickled	70	120-150			
pickled	80	120-150			
Monel metal, cast	80	120	150	150*	buff
deep-drawn	120	150	180*	buff	
full-finish sheet	180	180*	220*	buff	
Stainless steel, mirror finish	60-80	100-120*	150*	220-3F*	buff
commercial finish	80	100*	120*	150*	

Note—All recommendations are for aluminum oxide. Sizes are for ordinary commercial finish.
*Indicates grease or oil wheel.

Contour-boring attachment on No. 12 Gisholt automatic - production lathe is specially tooled to finish inside of pressure-cooker casting. Guard ring was removed from chuck for this picture

SPECIAL TOOLS BORE ALUMINUM CASTINGS

In a continuous cut at nearly 3400 fpm., Stewart Die Casting contour-bores the inside of pressure cookers. Special tools and chuck make it possible



Standard carbide-tipped tool bores all sizes. It is used in inverted position, with lathe spindle rotating counterclockwise

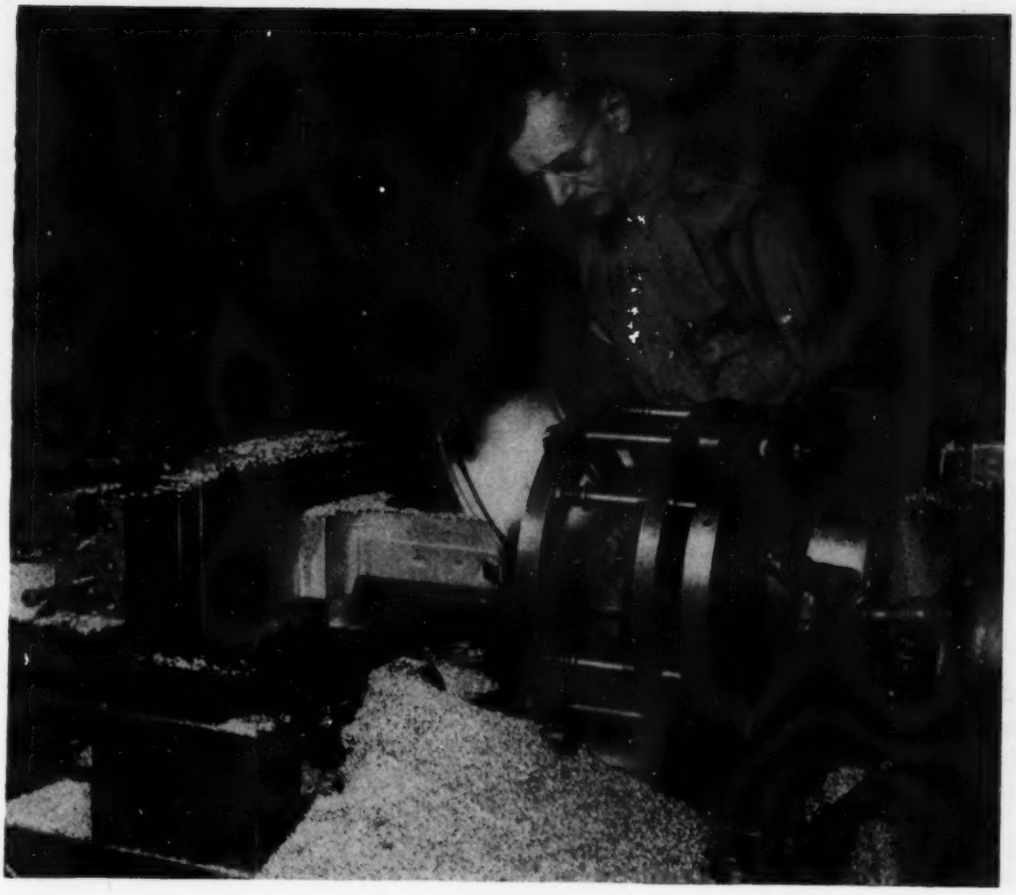
BY BEN C. BROSHEER
ASSOCIATE EDITOR

CAST-aluminum bodies for domestic pressure cookers are contour-bored with single-point, carbide-tipped bits at speeds ranging up to almost 3400 fpm. at Stewart Die Casting's Chicago plant.

The operation includes taper boring the walls and facing the bottom in one continuous cut with a standard No. 12 Gisholt automatic lathe equipped with an auxiliary toolslide on which is mounted a heavy boring bar. This bar can be bolted in different positions to suit the several sizes of bodies to be machined.

A special pot chuck has been developed for this operation. So this chuck can hold all four sizes of body casting, the spring-supported floating centering rings and clamping fingers can be changed. Each lathe is operated at 1,000 rpm., and bores are held within 0.010 in. of the specified size. Feed is about 0.030 in. per rev. Depth of cut averages about 1/16 in.

The pot chuck is air operated by means of a drawbar extending through the spindle of the lathe. This drawbar is connected to a spider having three arms, each of which carries a clamp-operating pushrod. Each clamp has a cam slot so it is both released and

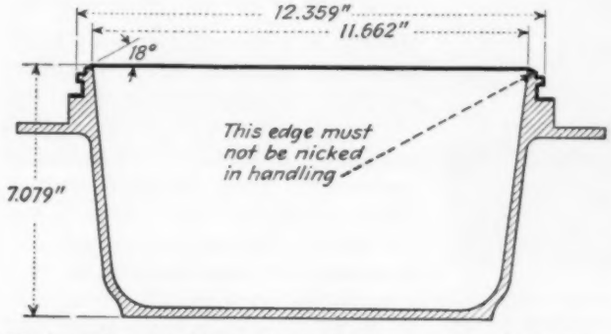


Floating centering rings of chuck are held against tapered walls of casting by springs. At end of cycle, boring tool withdraws so casting can be removed

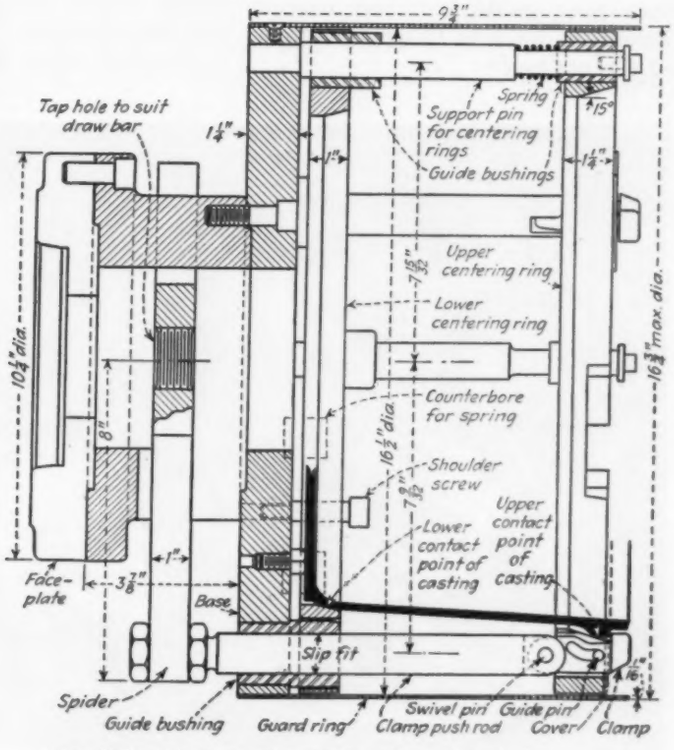
AT HIGH SPEED

moved away from the work when the spider is pushed forward.

Two horizontally floating centering rings in the chuck are each supported by six equally spaced pins arranged in a circle about the periphery of the chuck's base plate. Adaptor ring which mounts this plate on the faceplate of the lathe



12-qt. cooker is shown here. The 9- and 16-qt. bodies, which are held in the same chuck, are about 1 in. smaller and larger in diameter, respectively



For different sizes of castings, the centering rings and springs are changed. Pads of sponge rubber are cemented to the base of the chuck to eliminate chatter

is slotted for clearance of the three arms of the spider.

The front centering ring is cut away at two positions to provide clearance for handles on the body castings. A hand brake operates on the lathe faceplate to stop the spindle quickly after a machining cycle has been completed, in order to minimize reloading time.

A standard hydraulic pump on the headstock of the lathe supplies oil under pressure to the longitudinal cylinder and the auxiliary tool slide cylinder through flexible-rubber hose. Valves controlling these two cylinders are operated to provide an automatic machine cycle.

Forward movement of the boring tool is provided by the independent slide set parallel with the center of the machine spindle. A roller on the hydraulically operated auxiliary slide follows a taper cam bar at the rear of the lathe to guide the tool while taper boring the walls of the part. The independent slide is brought against a positive stop when the tool reaches the bottom of its boring cut. At this point, the auxiliary slide passes off the taper guide bar and moves across the lathe to face the bottom of the pot body.

Trimming presses, designed and built by Stewart, trim castings before machining. A 10-in. stroke, 4½-in. bore cylinder above the press, is operated from the shop's 1000-psi. hydraulic system. Valves are arranged for safety with two-hand control

When the boring tool reaches the center of the work, the auxiliary slide stops and the independent slide is returned to starting position; at the same time, the power of the machine spindle is shut off. Then the auxiliary slide is returned to its original position and the independent slide advances a short distance to bring the roller back into the straight section of the cam guide bar. Here, the boring unit comes to rest until the operator has loaded a new piece into the pot chuck and starts the lathe for the next cycle.

At first, considerable difficulty was experienced with chatter while the boring tool was facing the bottom surfaces of the pots. This condition was eliminated by fixing several sponge rubber pads to the face of the baseplate in the pot chuck. Thickness of the pad in each case is sufficient to insure adequate compression pressure when the body casting is drawn against the centering rings.

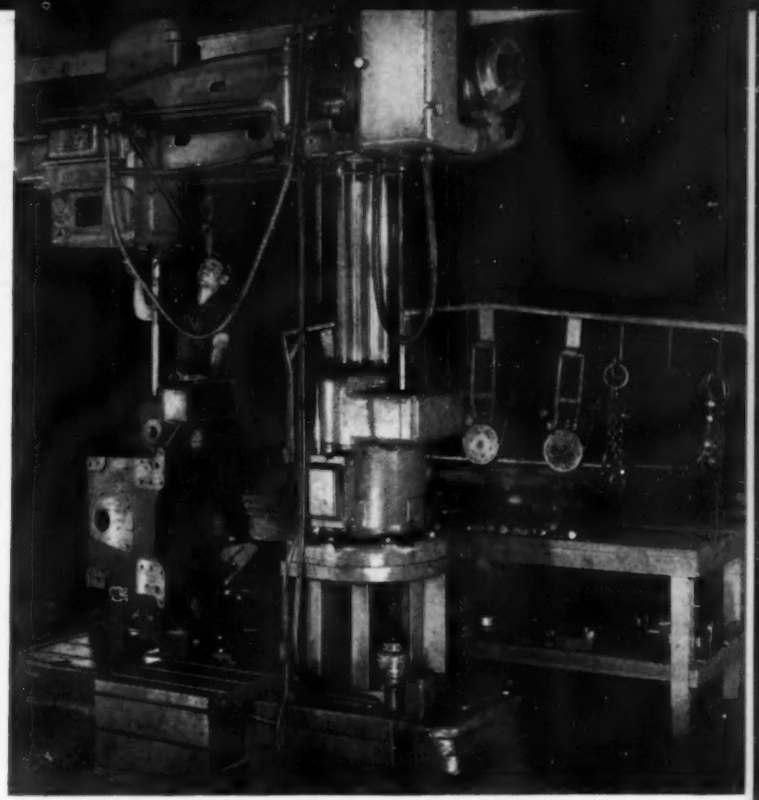
Finishing operations employ special drilling and tapping machines. This one drills handle holes and has two Model 18 Kingsbury heads, each with a two-spindle Ettco drillhead. An air valve controls the two toggle clamps which hold the casting in position on the jig plate, and also starts the automatic drilling cycle

EMANCIPATED BUILDER

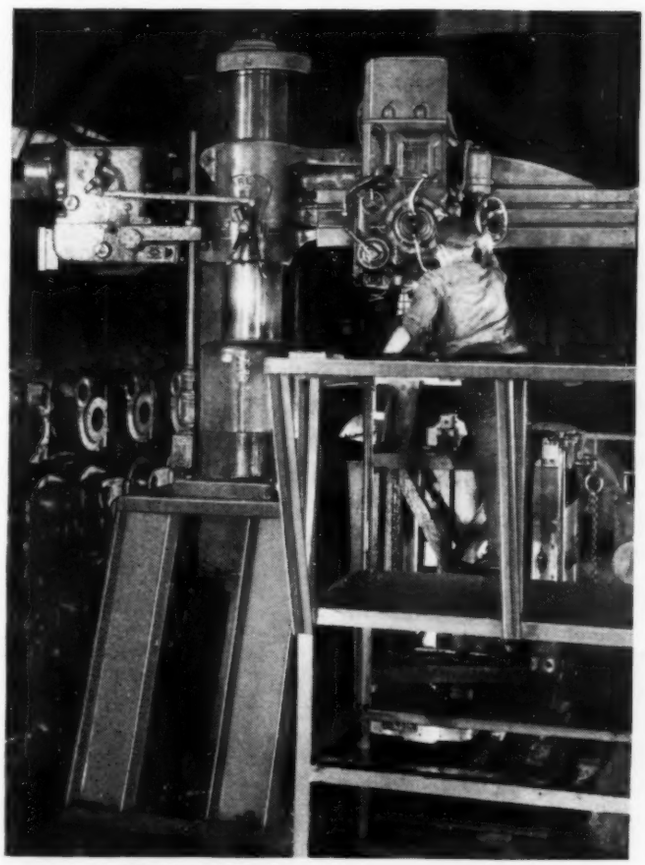
Hydraulic means of operation with electrical control have emancipated the builder of special machines according to H. N. Maynard, president of Snyder Tool & Engineering Co. They eliminate special shafts, cams and gear trains to interconnect operations, result in new ease of modification to suit changes in the product. Today the heads of special-purpose machines are being rebuilt without having to obsolete the basic machines.

STILTS STRETCH RADIALS TO FIT

Drilling holes in tall parts without employing oversize and over capacitied machines posed a problem until special raising blocks were used under standard drill columns



Welded steel raising block 25½ in. high increases clearance under spindle of this 5-ft. arm, 13-in. column radial sufficiently to permit drilling and tapping operations on ends of cast-iron drive housing for HD-5 crawler tractor. Operator stands on 36-in.-high wood platform to reach controls. Back of bench is rack with hangers for special multiple-spindle drillheads



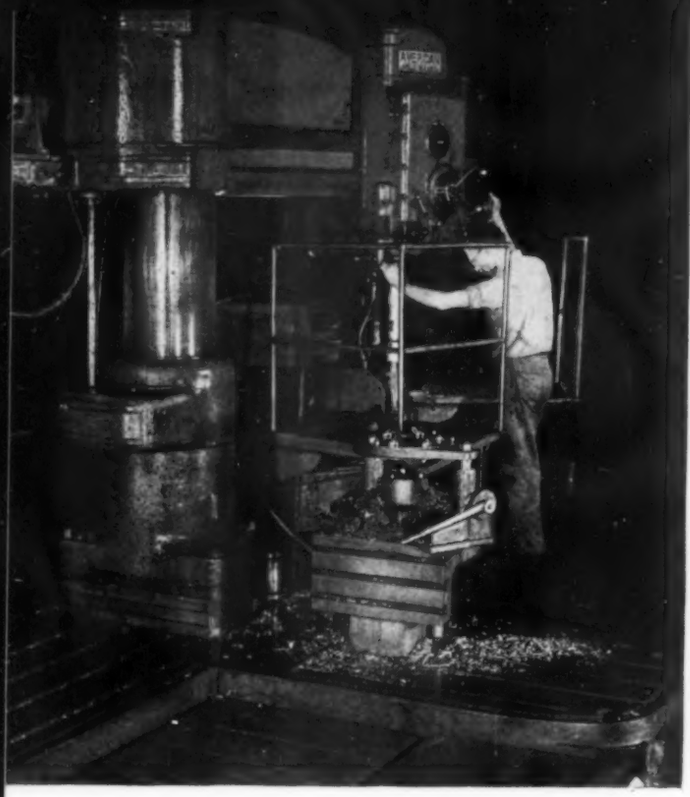
Trunnion fixture for steering clutch and final drive housing used in the HD-19 crawler tractor is combined with the 68-in.-high welded steel raising block under this 5-ft. arm, 13-in. column radial drill. Motor for rotating trunnion fixture is mounted between legs of raising block. Operator stands on 60-in. high, 3 x 6-ft. welded steel platform which has 16x72-in. shelf on outer side to hold tools. Platform is mounted on four casters so it can be moved about the floor as needed

BY BEN C. BROSHEER, ASSOCIATE EDITOR

LARGE castings and weldments of complicated shapes must be machined for Allis-Chalmers crawler tractors. In some cases, castings to be drilled are so large there is not sufficient clearance under the drillheads of radials having standard-height columns.

During modernization just completed at Springfield works, considerable attention was given to the capacities of the machine tools purchased, in order to keep capital investment charges within reasonable bounds. In a number of instances, it was found that drilling, tapping and counterboring could be performed with standard 5- and 6-ft. arm radials when clearance was increased by providing special raising blocks under the column bases.

Where clearance under the spindle need be increased only up to about 12 in., the raising blocks consist of steel plates flame cut to the shape of the column-base casting, and with opposite faces ground parallel. Holes are drilled in these plates to clear the hold-down bolts, which are made of extra length to pass through the raising plates and enter the original tapped holes in the floorplate. Where higher raising blocks are needed, they are built up by welding together standard steel sections as shown. Most of these welded blocks are 20 to 30 in. high, but in one instance, the block assembly is 68 in. high. In this case, the base of block extends the full width of the baseplate for stability. (*Next page, please*)



STILTS STRETCH RADIALS
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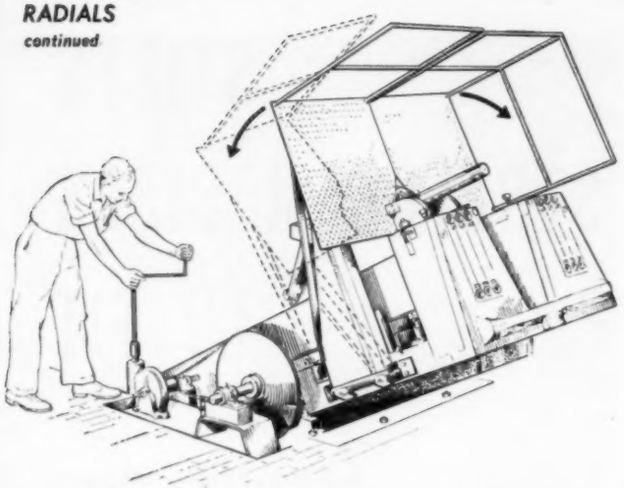


Four steel plates, flame cut to fit column base and drilled to clear hold-down bolts, make a 9-in. block for this 6-ft. arm, 17-in. radial. Machine is used for several operations on tractor parts. On opposite side is a pit-mounted trunnion fixture for drilling 12 holes in one end of tractor frame and for boring a 3¼-in. hole 16¼ in. long. Operator's platform is split to swing aside for loading with fixture horizontal, and so operator can work with boring bar when fixture is vertical

Production Grinding Alnico Rotors

Built-in wheel dressers, automatic sizing, Carboloy centers and cam dogs combine to increase production 500% and greatly improve wheel life

By RALPH E. ROBERTS
General Methods Section
General Electric Co.
West Lynn, Mass.

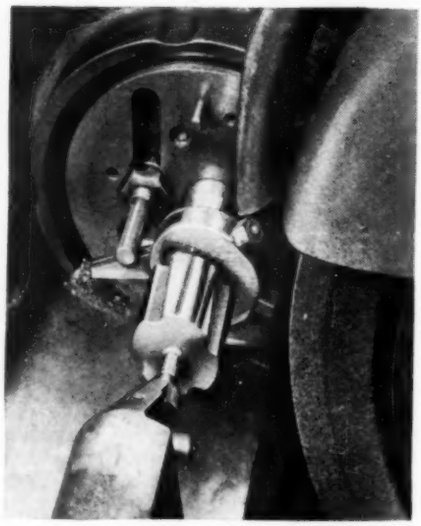
PRODUCTION of Alnico magnet rotors for aircraft generators presents many problems, one of which is the grinding of the O.D. from the rough casting to a finished dimension of 1.5145 ± 0.0005. This rotor consists of an Alnico casting on a stainless steel tube and has four helical grooves cast into the outer surface. The sprue is hand ground from the cast portion, and both ends of the tube are countersunk prior to grinding.

A new method for grinding these rotors resulted in a 500% increase in production per man-hour, reduction in operation costs to 1/5 of the original method, and annual savings amounting to thousands of dollars.

Under the original grinding method, the operator assembled the grinding dog and tightened the conventional setscrew. He then greased the centers of the rotors, placed the assembly between the centers of the grinder, and started the table traverse. The infeed was operated by hand until all bumps and scale were removed, and then operated automatically to the stop. Finally, the operator checked the rotor for size with micrometers and ground it to finished size. The machine used was a standard, mechanically operated cylindrical grinder.

The original method necessitated the use of the hand infeed because of bumps or scale which is very hard, difficult to remove and inclined to clog the grinding wheel. This made it necessary to dress the wheel every three or four pieces.

The new method calls for two hydraulically operated grinders, one with an oscillating spindle for rough grinding, and one with a stationary spindle for finish grinding. Dimensions on the rough grind are 1.5225 ± 0.0025, and on the



Increased production and accuracy, and higher wheel life are obtained through this special setup on a Norton grinder

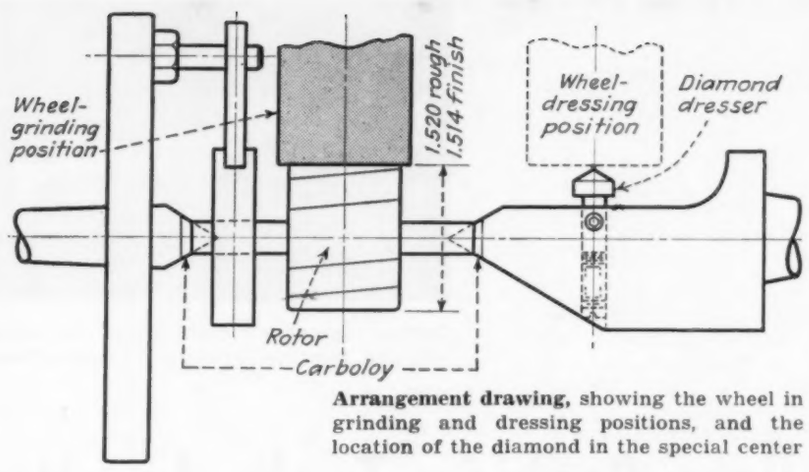
finish grind are 1.5145 ± 0.0005.

The centers are Carboloy tipped which eliminates greasing the rotor centers, because the soluble oil coolant provides sufficient lubrication. The tailstock center is made special with the portion from the taper to the start of the center angle being 2 in. in dia. and milled on the inside to within ¼ to ⅜ in. of the center line.

A dressing diamond, with a setting adjustment, is installed in this portion of the tail center. It is set so that when the wheel is dressed and the stops left as they are on the completion of dressing, the ground rotor is within the desired limits.

A go and no go snap gage is used for checking rough grinding, and experience has shown that when the wheel is at maximum diameter it is necessary to dress after every 12 pieces. When the wheel has worn to its smallest usable diameter it becomes necessary to dress after every six pieces. The dressing setup is an integral part of the machine and gives automatic sizing. Dressing time is 90 sec., and includes one ground piece.

Wheel traverse goes through three separate stages. The first is a fast in-travel toward the work, followed by a cushioning period, during which the in-travel rate is reduced gradually to the last stage, which is the actual grinding infeed. Advantage is taken of the cushioning period by setting the machine so the bumps and high spots are removed at that time. Approximately 0.038 in. is removed in the last stage of rough grinding. The oscillating spindle is used in plunge grinding for the roughing operation, and cycle time is 27 sec.



Arrangement drawing, showing the wheel in grinding and dressing positions, and the location of the diamond in the special center

Roller conveyors are installed between the rough and finish grinders with ample storage capacity to allow an extra shift's production. This is necessary because rough-grinding time is approximately twice the finish-grinding time.

Finish grinding is done with a stationary spindle and an oscillating table, the grinding cycle being 15 sec. A bench dial indicator is used for checking finished size. Wheel dressing is required only once for 96 pieces. This increase in wheel life is natural, because the difficulties of bump and scale removal are eliminated by the rough grind.

Changes in normal operating temperatures of the finish grinder, because of room changes or because the machine had been idle between shifts, caused slight but objectionable differences in the final dimensions of the rotors. To eliminate warming up the machine and to compensate for room temperature changes, a thermostatically controlled heater is now installed in the hydraulic-oil reservoir, and the hydraulic pump is operated continuously, whether the machine is being used or not.

Quick-acting lever-cam type grinding dogs have been substituted for the setscrew type, eliminating the need for a wrench, and cutting down the time for dog assembly. Two dogs are available at each machine, so while one part is being ground, the next can be made ready.

To simplify setting up the machines and to avoid the time-consuming trial-and-error method, setup record cards are prepared. These give complete information for setting all stops and valves on the machines, the type of coolant to be used, work speed, and type of wheel required.

NORTON TYPE C GRINDER SETUP RECORD

Drg. No. 414324 Oper. ROUGH GR (PLUNGE) OD 1.520 1.515

Wheel G.E. CODE 97 Work Speed 230 RPM

Timer 27 Sec. GRIND FEED Needle Adj. 0

Gr. Feed Travel .038 In. Cush. Feed Lgth. 9/32 In

Gr. Wheel Travel 2 In. Cush. Valve 1/2 Turns Open

Table Trav. Adj. - GRIND - Dist. From Stop Screw 0 In.

Table Trav. Adj. - TRUE - " Stop Screw Out 3/8 In.

Coolant Compound - G.E. 764-A 1 PART TO 40 PARTS WATER

Mfg. Methods Dept. J. Doe

NORTON TYPE C GRINDER SETUP RECORD

Drg. No. 414324 Oper. FIN GR O.D. TO 1.5145 ± .0005

Wheel G.E. CODE 42 Work Speed 230 RPM

Timer 15 Sec. GRIND FEED Needle Adj. 4

Gr. Feed Travel .006 In. Cush. Feed Lgth. 13/64 In

Gr. Wheel Travel 1/8 In. Cush. Valve 1 Turns Open

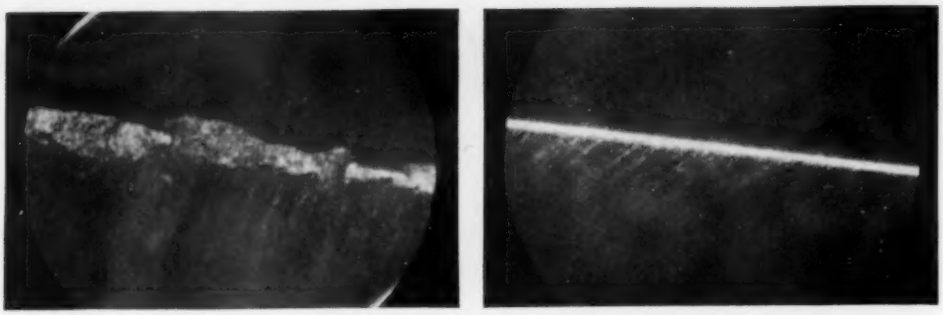
Table Trav. Adj. - GRIND - Dist. From Stop Screw 1/4 In.

Table Trav. Adj. - TRUE - " Stop Screw Out 19/32 In.

Coolant Compound - G.E. 764-A 1 PART TO 40 PARTS WATER

Mfg. Methods Dept. J. Doe

Quick setup is made possible through the use of special cards on which all pertinent setup information is listed



Cutting edge of a carbide-tipped tool, showing the difference between offhand grinding, left, and grinding according to instructions, right. Magnification 40 X

How Carbide Tools Are Handled in Finland

Operation sketches and detailed instruction sheets

help carbide tool grinders in Finnish machine shop do accurate work

BY HANS BRANDERS, KARHULA, FINLAND

CARBIDE-tipped tools for machining have increased enormously in the Scandinavian countries during the past two decades. It has become obvious, however, that not all users are familiar with the properties of carbide tools and the technique of caring for them, in spite of the propaganda and the elaborate instructions that carbide manufacturers have distributed. Even in the best-run shops, management has often failed to pass on to the foremen and operators the necessary instructions.

For every material, every machine tool, and every different grade of carbide there are optimum operating conditions of feed, speed and depth of cut, all of which have an influence on tool life. And to determine the actual cost of using carbide tools, the cost of regrinding must be definitely established. Much work along these lines has been carried out in recent years in the Scandinavian countries, the most advanced research having been performed by Professors Woxen and Svahn at the Royal University of Technology in Stockholm. Their findings have been of great value to machine shops throughout Scandinavia, and the author's plant in Finland has set up its toolroom along the lines indicated by this research, to obtain maximum efficiency and economy in regrinding tools.

Effect of Finish

After a considerable amount of research work and tests to determine the tool life of different carbide-tipped lathe tools, it was confirmed that the finish of the tool, and particularly the finish of the cutting edge, has a marked influence on tool performance.

The illustration above shows the difference between a lathe tool ground and lapped in the toolroom in accord with the instructions given to a toolroom grinder, and a tool ground by hand by a lathe operator on a 46-grain silicon-carbide grinding wheel. The magnification of the microphoto is 40 times. Although the microphoto of the hand-ground tool shows the most ill-treated part of the cutting edge, it is not necessary to make a running test to see that it is far inferior to the tool ground in the toolroom.

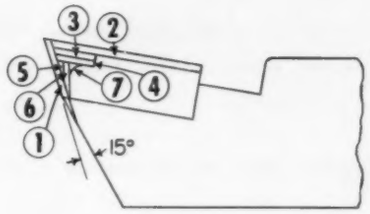
Numerous trial runs, experiments and studies with photomicrographs have shown that finish grinding and lapping with a grain size of 400-500 gives considerably better results than with a coarser grain. This is particularly true in the case of chip-breaker grinding, where the grinding is done parallel to the cutting edge, a practice generally to be avoided in carbide tool grinding. Extensive tests have shown that grinding at a right angle to the cutting edge, or an angle approaching a right angle, is the most satisfactory practice.

Detailed Instructions

A grain finer than 500 has comparatively little influence on the improvement in tool life and makes grinding too slow and costly. Compared with a coarser grain, lapping with a 500-grain diamond file or diamond wheel, and grinding with a 46-grain silicon-carbide wheel, shows, in some cases, a 100% improvement in tool life in favor of the finer grain.

With these findings in mind, clear and detailed instructions were prepared for the grinder operators in the toolroom, showing by means of exaggerated

How to sharpen a dull carbide-tipped tool



ITEM	MACHINE	TYPE OF GRINDING TOOL	OPERATION
①	02-27	Cup wheel Silicon carb 46-J 8-V	Finish grind front clearance. Clearance angle 7°
②	02-27	Cup wheel Silicon Carb. 46-J 8V	Rough grind top rake. Rake angle 8°
③	02-32	Straight wheel 6. in. diamond DIT-D120-L100 M⅛	Rough grind chip breaker according to special form.
④	02-32	Straight wheel 7 in. diamond DIT-D400-L100 M⅛	Finish grind chip breaker according to special form.
⑤	02-19	Recessed wheel Diamond D6W-D120-L100 M⅛	Lap front clearance. Clearance angle 5°. Width of face 2mm.
⑥	02-19	Recessed wheel Diamond D6W-D400-L100 M⅛	Finish lap front clearance. Clearance angle 5°.
⑦	hand	Diamond Handhone Grain 400-500	Lap cutting edge lightly by hand with handhone.

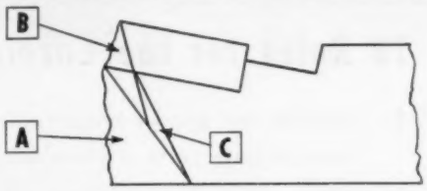
Instruction sheet for grinding a carbide-tipped lathe tool for machining steel. Stock removal is shown greatly enlarged for clarity

sketches the various steps involved in sharpening a new tool and resharpening a used tool. These were distributed to each operator involved, and also posted in prominent places in the toolroom.

To make possible an effective tool service, a close and elaborate standardization of all lathe tools was made. A large stock of all standard tools was arranged in the tool crib in connection with the grinding crib. Two standard sets of tools, one for machining steel and one for machining cast iron, were distributed to all lathe operators. A worn tool can thus be instantly exchanged for a new one at the tool crib. The worn tool is then passed immediately to the grinding crib. To keep track of the grinding turnover of every tool, each is marked with a small punch mark at the back end of the shank every time it is sharpened or handled in the grinding crib.

Grinding instruction sheets were also prepared

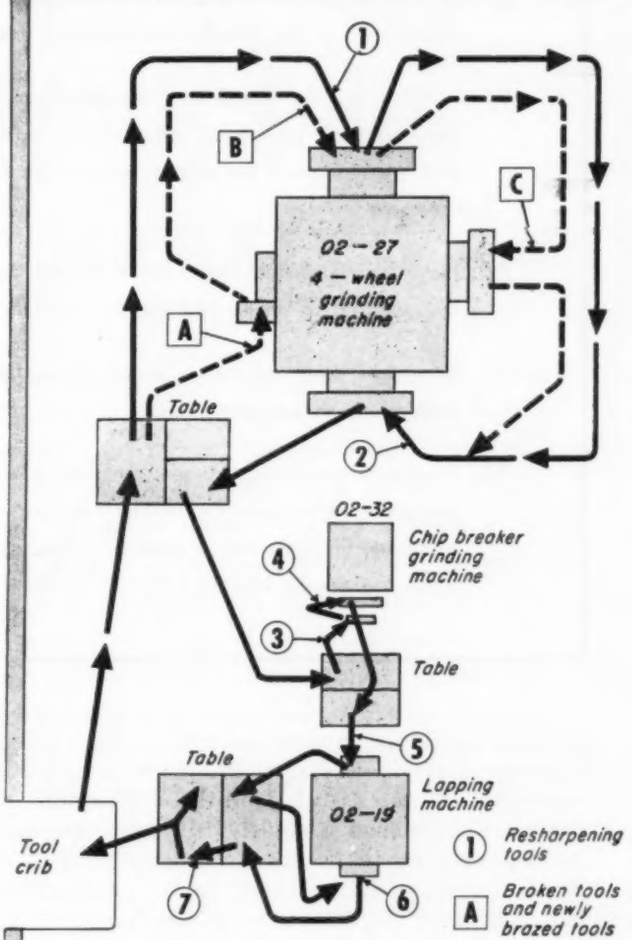
How to grind a new or broken carbide tool



ITEM	MACHINE	TYPE OF GRINDING TOOL	OPERATION
A	02-27	Straight wheel Alum. oxide 24-Q 6-V	Remove shank material up to seam of solder. Clearance angle at 15°. Never touch carbide tip with wheel.
B	02-27	Cup wheel Silicon carb. 46-J 8-V	Rough grind front clearance. Clearance angle 7°
C	02-27	Cup wheel Alum. oxide 24-Q 6-V	Finish grind shank front clearance. Clearance angle 15°.
			Continue as per instructions for regrinding similiar type of tool.

Broken tools, and those with newly brazed tips, are ground according to instruction sheets of this type before using sheet shown in preceding illustration

Floor Plan of Carbide Tool Grinding Crib



Grinding crib layout, showing flow of new and reground tools to the various machines. Machine numbers correspond to those on grinding instructions

10 Rules for the Carbide Tool Grinder

1. Carbide tool grinder remember: Tools of great value are passing through your hands. The most delicate parts of those tools—the tips—are to be purchased with valuable foreign currency.

2. Handle the tools carefully. Remember that even slight impacts are able to destroy them. Therefore, always use soft beddings when handling tools tipped with carbide—for instance, wood.

3. Be careful never to touch the tool shank or tool body to a diamond wheel. The diamond wheel easily fills up with steel and will be damaged. The diamond wheel is a very expensive agent in servicing carbide tools.

4. Before you start grinding, be sure that the grinding equipment is in order and that the wheels do not run out of round, or are warping. Notify the toolroom foreman if you need help in correcting the faults. Do not use the equipment before the faults are corrected.

5. When a silicon carbide or an aluminum oxide wheel warps or cuts improperly, it has to be trued with the help of a diamond. Do not true it freehand: Use the truing tool holder provided.

6. Be sure the diamond is in the correct position when truing, as in the sketch below. Contact the wheel face in the middle and traverse evenly in both directions.

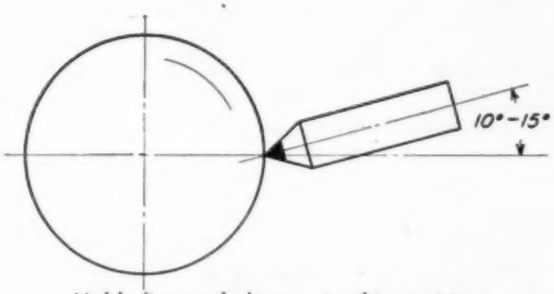
7. After truing the wheel with the diamond it may be necessary to dress it with some kind of dressing tool, preferably an abrasive dresser. Use moderate pressure when dressing the wheel and when moving the dresser across the face of the wheel. A badly dressed wheel will spoil the tools.

8. Never grind carbide with an aluminum oxide wheel. If you encounter difficulties in separating the grinding of shank and tip, use a silicon carbide wheel.

9. When grinding wet, use a liberal supply of coolant. An insufficient supply is more dangerous than using no coolant at all.

10. Your profession is quite new and has a great future. Take an interest in your job and study the given instructions carefully. You are carrying a great responsibility because your skill in grinding the tools has a marked influence upon the successful use of the tools in the shop and upon the results obtained by your fellow workers when operating the machine tools.

for carbide-tipped cutters, as well as for ordinary high-speed steel cutters, drills, reamers and other tools. Sets of rules, each comprising 10 points, and consequently known popularly as the ten commandments, were made up for each type of toolroom grinder, such as drill grinder, carbide tool grinder, cutter grinder, etc. These were distributed to each grinder operator and, in combination with the instruction sheets, have had a marked effect in improving tool life.



Hold diamond dresser in this position

SIMPLE WORKHANDLING and coil design can provide high production rates. Here lubricator subassemblies are brazed as they pass through a long, narrow, single-turn coil

How to Design Work Coils for INDUCTION HEATING

By BEN H. GRIFFITH, Jr., and RAY SKIBA
ELECTRONICS SECTION, ALLIS-CHALMERS MFG. CO.

HALF a dozen years ago, high-frequency heating began to emerge from the laboratory with manufacturers processing sample workpieces, designing and building the work coils and fixtures, then installing the tooled equipment.

Users have found induction heating, once installed, applicable to many other jobs; but have, in most cases, had to go back to the maker for the necessary coils and fixtures—or even to take care of modifications. With the information provided here, however, users can develop their own coils, saving time and money and making induction heaters versatile and adaptable production-line tools.

Initial pages of this report describe the practical mechanics of coil construction and methods of arriving at final coil design. Theoretical calculations leading to the design are included in later pages, although they are usually too complex to use in the shop. Theory is not ordinarily needed, however; understanding and application of the basic principles here outlined will result in properly designed coils which can bring masses of metal up to temperature like magic, without requiring the coil builder to be a magician.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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Job Requirements Influence Coil Construction

1. Sample coil of the simplest type. Both water-cooling and electrical connections are made with flare nuts

THE PURPOSE of the work coil is to transfer the energy from the induction heater to the work itself. To do this, it must, first of all, be efficient. The leads must have as little impedance as possible. These requirements can be partially met by keeping the leads from the coil as close together as possible, and by keeping the current-carrying surface at a maximum. The connection surfaces must be clean and bright, with a maximum contact area.

It must be remembered that production is the main consideration, so work coils must be constructed to give maximum production from the heater. In addition, they must be mechanically strong, so they are not easily broken or deformed. Even slight changes in shape can greatly affect the efficiency of some coils.

The design of work coils from a practical viewpoint will be outlined below (metallurgical treatment not included). Further, the quench used in treating of metals determines to a great extent the quality of the product. The design of proper quenching equipment is a complete problem in itself, especially when combined with induction heating for the treatment of steels.

Tables are available giving the watts per square inch values for many common induction-heating applications, but they are difficult to use, except as a guide after some experience has been gained in coil building. However, a sample coil should be built and tried. This coil should be as simple as possible, but built with enough care so that the results will be a true indication of the design characteristics. After tests have been run, the results must be interpreted. The following interrelated aspects must be considered:

1. Degree of loading of machine.
2. Amount of power available with respect to the amount of metal to be heated.
3. Rate of heating of piece.
4. Number of pieces to be heated at one time.

As in most equipment, the most economical load for a heater is the rated load. The induction heater, because it is most efficient at or near rated output, and because the cost is based upon rated output, should be operated as close as possible to 100% full load. The degree of loading depends upon the metal in the workpiece, the coupling (closeness of work coil) to the work, and the number of pieces in the coil.

Any heater has a limit to the amount of metal it will heat in a given time for a given job. If the heater will not do the work, using a properly designed coil, it is too small. On the other hand, if the work is heated properly and the machine load is far from full load, more pieces can be heated at one time.

The rate of heating of the piece depends upon the piece and the operation to be performed. To caseharden a piece of steel, surface heat must be generated fast enough so the heat cannot penetrate deeply into the metal before quenching. On the other hand, in brazing applications, a slower heating rate (and usually a lower temperature) is required because the flowing of the brazing agent must be complete. Other induction-heating applications, such as soft soldering, annealing, and melting, require correspondingly different heat conditions.

Now, of course, the number of pieces which can be heated simultaneously depends upon the rate of heating of each piece and the percentage of the full load one piece may take. Thus the number of pieces should be such that full load is drawn and each piece is heated at the correct rate.

Let us examine a basic procedure which can be used on typical induction-heating jobs:

Heat-treating

The problem is to caseharden to 0.060-in. depth a 1-in. length of a 1-in. dia. SAE 1040 steel rod.

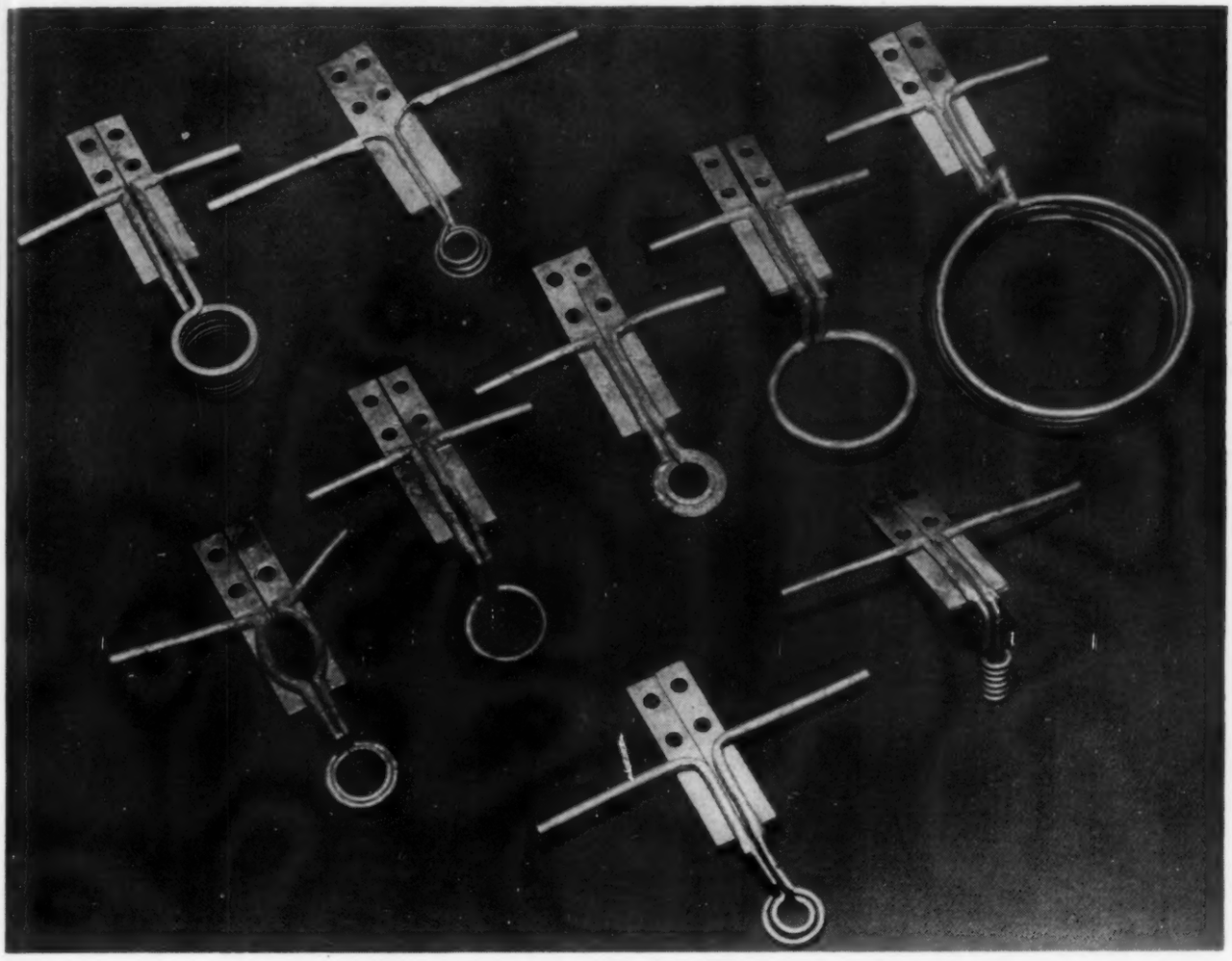
First of all, the generator frequency must be high enough to keep the induced heat near the surface of the work, and the machine must have sufficient power output to keep the surface heat from penetrating into the core farther than the required 0.060-in. depth (this would cause embrittlement of the core).

The coupling required to produce full load of the machine is different for each type of machine on the market. Some units are designed to allow the coils to couple to the work by varying amounts. Other units require extremely close coupling between the work and the coil, allowing less leeway in coil design.

Coil Principles

The ideal coil is one which fully loads the unit (although anything over 85% loading is usually considered satisfactory) without making the workhandling problem too complex. A clearance of 1/16 to 3/32 in. between workpiece and coil is the usual minimum. Anything closer than this means that workhandling equipment must be designed to very close tolerances. While this may be possible, it is not easy, especially at high production rates.

The work coil for hardening the bar in the problem might consist of one turn or several turns. The heating could be done in one shot or progressively by moving the bar



MANY COILS can be matched to the same heater. All these have copper bus for support and electrical connections; final cooling-water connections are not shown

through the coil. If progressive feed is chosen, a single turn of small-diameter tubing can be used for the trial coil.

When a production-size induction heater is fully loaded, a very heavy current is flowing in the work coil. From a practical standpoint, it is almost impossible to design an efficient coil for such heaters that does not require water cooling. Thus, any coil design must provide a path for cold water adjacent to or as part of the coil itself.

Build a Sample Coil First

With these facts in mind, a sample coil can be made up of copper tubing, because it is usually the simplest form of coil and provides both electrical and water connections at one pair of terminals. A clearance of 1/16 in. around the rod can be used for the trial. Tubing having a 3/8-in. diameter and wound on a 1 1/8-in. form would provide a good start (Fig. 1). Leads to the coil should be kept as short and as close together as practical (without, of course, the danger of touching). The trial coil should be made as accurate as possible so results will be indicative of what to expect in the final coil.

With the coil connected and water turned on, the sample can be placed in the coil and the power turned on. If the unit is overloaded, as indicated on the load ammeter, the clearance between coil and workpiece must be increased until the machine is operating within its rating.

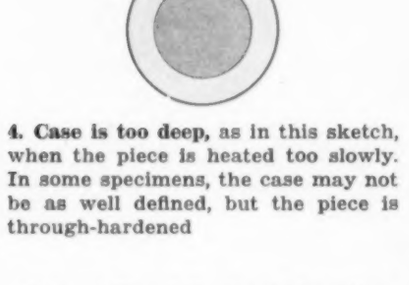
On the other hand, if the machine is loaded at below 85% full load, efficiency is low and the coil should be investigated for possible loss.

If no losses are found, the coupling may be increased, but this will make the workhandling problems more difficult. There is also the possibility that, in the case of a vacuum-tube oscillator heater, the coupling was already too close, blocking the oscillator. In this case, a high degree of loading will be indicated on the plate meter with no apparent heating in the workpiece. This may be corrected by decreasing the coupling.

Check Sample Work

Provision for quenching should be made at least temporarily so hardness of the sample can be checked. Without provision for checking, any coil designer is still working in the dark on heat-treating jobs. The sample should be cut both axially and radially to check the heat pattern. The case should be a well-defined area of the proper depth without a "burned" area.

2. Satisfactory case-hardening on 1-in. bar stock, etched, should look like this sketch, or as in the photo of a pin. It requires care in designing the work coil



3. Case is too thin, edges are rough and burned, as in this sketch, when heat is applied too rapidly.

4. Case is too deep, as in this sketch, when the piece is heated too slowly. In some specimens, the case may not be as well defined, but the piece is through-hardened

The profile of the heated sections should be checked. Results will fall into one of the three following classes:

1. *The case may indicate a well-designed coil* (Fig. 2) that with slight modification will do a good job. The coil may now be redesigned to meet the specific production job using the coil-construction techniques outlined later.

2. *The sample may have burned surfaces and too thin a case* (Fig. 3). The reason for this is too much power is forced into the piece in too short a time. The time cycle should be lengthened. Three possible methods present themselves:

a. The work coil may be enlarged, thus decreasing the power into the piece. The result would also be a decreased load on the unit and thus a less efficient operation.

b. Reactance in the form of a variable series inductance may be added, with the same results as in the preceding paragraph.

c. One good solution is to make a multiple coil in which two or more pieces can be heated at the same time. This will allow operation of a fully loaded machine for a longer time cycle and, therefore, a deeper case.

d. If the area to be hardened is larger than that treated with the sample coil, as it is in this example, the final coil can be modified with the same results as adding more pieces. For instance, two or three turns of square copper tubing or a single heavy turn of 1-in. wide copper bus might be used for a final coil.

3. *The hardened zone on the sample may be too deep or all the way through* (Fig. 4). The cause is too long a heating cycle. If no case is obtained when the cycle is shortened, the machine does not have enough power to do the job with the sample coil. The next step would be to reduce the projected area of coil on the surface of the rod by using a smaller tubing for the sample coil. If this fails, the heater is too small.

While these are the steps suggested for a relatively simple heat-treating application, the same procedure can be followed for even the most complicated coils. Experience will bring with it many short cuts to this process. Later are listed many of the coil variations that can be used.

Designing Coil for Brazing

Brazing and soft soldering represent quite a different problem in coil design. Here the goal is to get the heat into the workpiece slowly so the heat will penetrate, bringing the brazing zone or zones up to the temperature needed to procure a good bond.

Let us examine the steps in designing a coil for brazing the joint in the assembly shown in Fig. 5. It is here that the thin sections must not be heated too fast compared to the thick sections having greater heat capacity, or burning will result. Because the pipe has the heaviest wall, the coupling should be closest to it, providing at the same time sufficient coupling to heat the shell and apron.

We have here a choice of heating this workpiece from the inside or the outside. As an inside coil would require longer leads, with lower efficiency and probably more difficulty in work-handling, an outside coil was chosen.

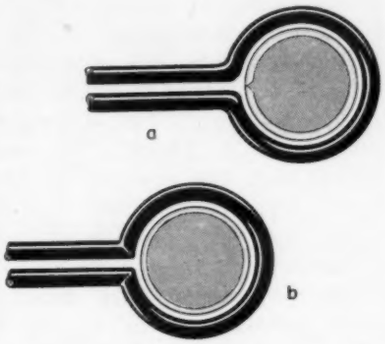
The next step is to make up a test coil following the same procedure as in the previous example, remembering that we wish to heat the piece slowly and, at the same time, strive to utilize the full output of the heater by loading into it as many pieces as possible at one time.

The resulting coil will not require careful machining, so a ¾-in. I.D. coil made of 3/16-in. copper tubing might be a good choice. The workpiece can be shifted up and down to get the proper heat proportions in the pipe and in the shell and apron.

Results can then be judged as in the previous example, sawing through sections of the braze to check its effectiveness, and modifying the final coil to suit the results.

5. Uniform bonding at the brazed joint is shown in this photo of an oil filter joined by induction heating

6. Simplest form of coil for brazing the filter in 5. Leads are bent to provide clearance.



7. If tubing is bent to form the coil, it is almost impossible to avoid the variation in case thickness sketched at *a*, unless the work is rotated while heating. Mitered joints, as at *b*, provide a uniform case

Actual Brazing-coil Design

The coil design chosen for this job on a production basis consisted of two coils in series, with inductances placed in series with each of the coils. The coils were wound with 3/16-in. dia. tubing on a ¾-in. form. On a 450-kc., 20-kw. heater, the heating time was 30 sec., brazing two shells simultaneously. A ring made up of brazing alloy was inserted between the shell and the apron prior to heating.

With the above examples in coil-building procedure, we can proceed to the best known variations in coil design that have evolved in the past several years.

Single-turn Coils Are Versatile

Coils comprising a single turn are very versatile and can be readily modified to meet the demands of a surprisingly large number of the many heating problems encountered in actual practice. Simplest in design is one made of round copper tubing.

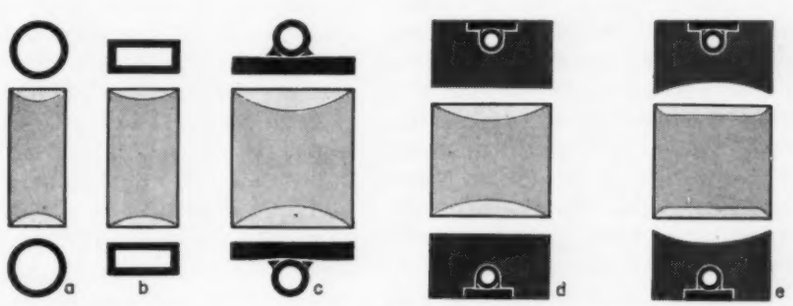
However, such a coil produces a heat pattern like that shown in Fig. 7a. By completing the coil circle and mitering and brazing the leads, as in Fig. 7b, a much improved and uniform pattern is obtained.

Fig. 8a shows the type of heat pattern obtained with such a coil. If the coil is combined with quenching apparatus adjacent to it and the work (a rod or shaft) progressed through the coil and quench, the result will be a hardened case, assuming that the material is of a hardening nature.

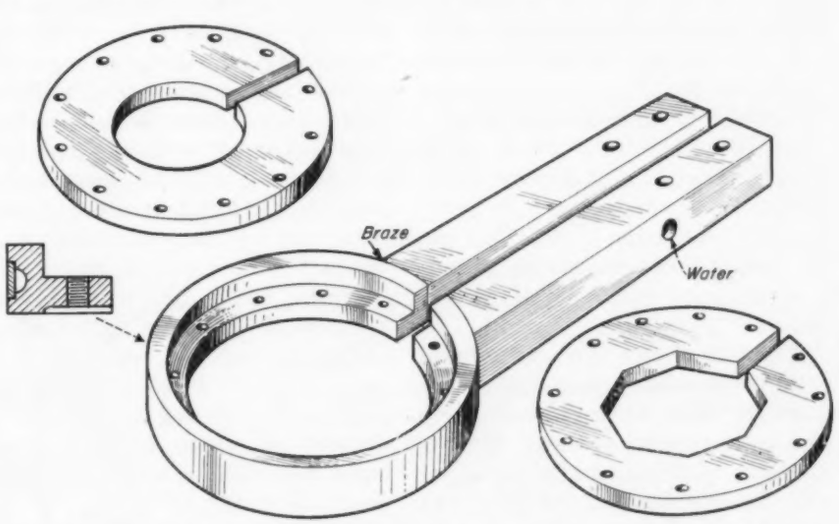
The heat pattern can be extended by using rectangular tubing, shown in Fig. 8b. A further extension of the heat pattern can be obtained by brazing a copper band of the required width on the inside of the copper tubing (Fig. 8c). This band need not be any heavier than 1/16 in. but it must be brazed to the copper tube, not soft soldered, because enough heat may be developed to melt the soft solder.

Single-turn coils thus far discussed are easy to make, but have the disadvantage that they can be easily deformed. Many production setups are such that it would be desirable to have a more rigid and durable coil. While it is possible to reinforce and support the above coils, a more satisfactory method is to machine the coil out of copper stock, as in Fig. 8d. A cooling channel is usually milled around the coil and a cover brazed over the channel. In making such a coil, it is well to bear in mind that the currents in the coil are confined to the surfaces adjacent to the inside diameter and to adjacent surfaces of the buses. In order to be effective, the cooling channel should be as close to these current-carrying areas as possible.

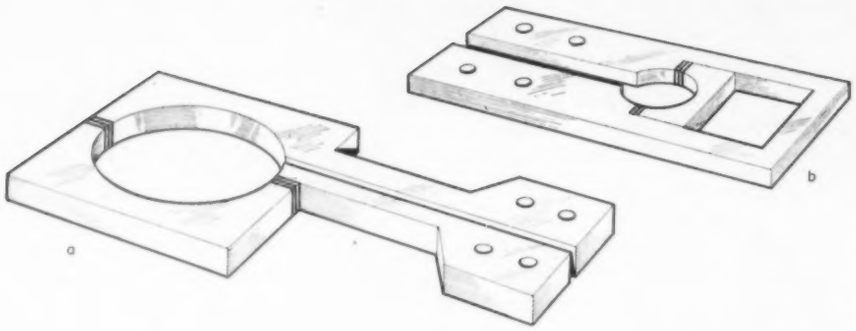
In Fig. 8d, it is seen that even with machined coils the heating pattern is not necessarily uniform, especially if the length of the heat pattern is appreciable as compared to the diameter. As the heat developed is a function of the flux linking the work, the heat can be



8. Heat patterns for five common coil cross-sections. With this as a guide, almost any desired heat pattern can be achieved



9. A removable-mount coil such as this will accommodate almost any type of insert. Inserts are cut from copper bus and bolted in place. Cooling-water passages are milled into the coil circumference and sealed with a brazed strip (lower left), and leads are rifle-drilled



10. If workpiece shape prevents free movement into the coil, hinged or semi-open coils such as these can be designed. Hinges and clamps are not shown, because of the variety of types possible. Silver contact surfaces are essential

decreased or increased more or less at will by changing the clearance between the work and the coil. By increasing the clearance (Fig. 8e), the heat pattern can be made uniform over the length of the heated zone.

It sometimes happens that a number of different shafts, pins, or rods call for the same type of treatment. A single coil can be made like that in Fig. 9, having removable inserts with different openings for each size or shape of work piece. From a production point of view, such a coil is time saving, rugged, and durable. It can be designed so a quench block is easily attached if desired. The problems involved in building this type of coil are such as can be readily handled by any toolroom or machine shop.

Occasions arise when it is necessary either to open or to enlarge the coil in order to get the work in or out. Figs. 10a and 10b show two such designs. The first is a split coil which is nothing more than a machined coil made in two parts having silver contact surfaces. It is necessary to clamp the coil firmly during the heating cycle. This can be accomplished by means of levers, solenoids, hydraulic or air cylinders.

Fig. 10b shows a machined coil with a movable insert which allows the piece to be removed from the coil without actually opening the latter. Considerable ingenuity can be exercised in the construction of these types of single-turn coils. It is well to point out, however, that the manner in which these coils work out in practice will depend somewhat upon the characteristics of the machine to which they are attached.

Multiturn Coils for Internal Heating

Coils having more than one turn comprise the other general category of induction-heating work coils. These coils are made from round or rectangular tubing. If it is desired to obtain high power densities it is necessary that the coil be wound with the maximum number of turns for a given length. Several factors, however, limit the extent to which this can be done.

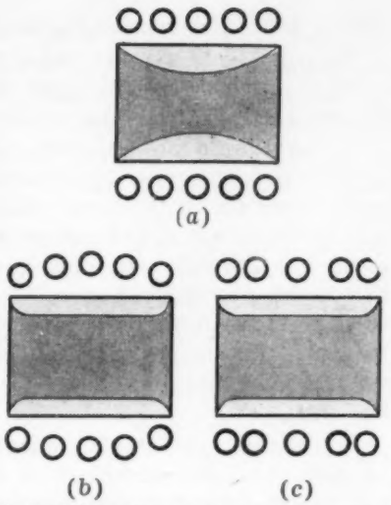
First of all, the tubing cross-sectional area must be sufficient to carry the currents involved. Secondly, the water flow through the coil must be sufficient to keep the coil cool. As a general rule ⅛-in. tubing is the smallest that can be employed on heaters rated 10 kw. or more—with 3/16-in. tubing preferred. And third, the voltages developed across multi-turn coils are higher than those on single-turn coils—so much so that, if the coils are large, it may be necessary to insulate the turns from each other. This can be done by baking an enamel coating on the coil, painting the coil with an insulating compound such as glyptal, or wrapping the coil with glass or cotton tape, then impregnating with an insulating compound. A simple coil using a newly developed porcelain enamel for copper is shown in Fig. 11.

Multi-turn coils of appreciable length can develop a wide variety of heat patterns. Fig. 12a shows a typical pattern obtained with such a coil. Notice that this pattern is identical to that obtained with the wide single-turn coil. The pattern can be corrected, as in the machined coils, by increasing the clearance between the work and the inner turns of the coil (Fig. 12b). To wind a barrel-shaped coil, however, requires the use of a formed mandrel and at best is a difficult job. An easier method is to vary the spacing between turns in such a manner that it is greater in those areas that would normally overheat (center) than at the ends, as in Fig. 12c. There is the possibility that the spacing between turns might be too great in which case the heat pattern will be striated.

Multi-turn coils are generally most satisfactory for heating internal surfaces of tubes, cylinders, and bores. All previous remarks relative to multi-turn coils apply to the so-called internal coils, except, of course, the heat patterns shown in Figure 12 will be reversed and will be on an internal surface.

Some difficulty may be encountered in bringing out both leads to the coil from one end, especially if the diameter of the coil is small. The winding of an internal coil can be accomplished on a hollow form of correct diameter, as in Fig. 13.

11. Enamel insulation for copper, recently developed, provides a sturdy, although very thin, insulation, unaffected by water and acids



12. Multiple-turn coils, closely spaced, provide heat patterns much like those of the wide single-turn coil cross-sections shown in 8

Sufficient length of copper tubing is fed through the tube and the coil wound on the form in such a direction as to double back over the lead. A notch cut out of the tube form will assist in making a neat bend in the lead to start the first turn. After the desired number of turns, the coil is slipped off the form and end-turn bent to bring out the second lead close to and parallel with the first. The leads are cut and bent as required for the particular case. Be sure that the tubing is thoroughly annealed before winding, otherwise the coil will spring out when finished, increasing the diameter.

Compared with coils which surround the work, these internal coils are relatively inefficient, and difficulty may be experienced in loading the heater to full capacity. This difficulty can be minimized by using rectangular tubing wound on edge and thus obtaining the maximum number of turns for the given coil length. Clearance between work and coil should be as close as is practicable.

Flat Coils Are Best For Flat Surfaces

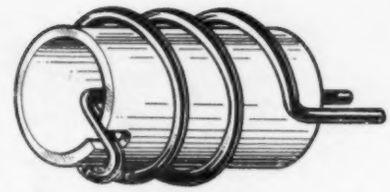
It may be necessary to heat flat or plain surfaces—pancake or flat coils like that shown in Fig. 14 are used for such applications. This type of coil is made by winding the copper tubing laterally, usually with some material such as soft brass or copper strip to provide proper spacing between turns during winding. Such coils can be made in any shape—circular, rectangular, square, etc. Unless this type of coil is braced with some insulating board, it may be very flimsy and can be easily deformed by the slightest jar. Fig. 14 shows such a coil brazed to ¼x1-in. copper buses, increasing both the rigidity and the efficiency of the setup.

Of the multi-turn coils this is by far the least efficient, and very close coupling is desired, although it is usually difficult to achieve on a production setup because of the danger of bumping or bending. It is not necessary to wind the coil with concentric turns. Flat grids of other design are possible, although efficiency is sacrificed.

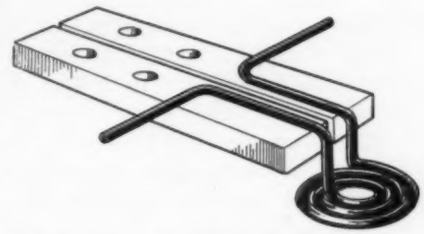
Combination Coils Require Cut-and-try

As was discussed, in those cases where the objects to be heated are small or where high power densities are not required, better production rates and higher machine utilization factor can be obtained by heating a number of pieces simultaneously. The work coil in such a case can be a number of identical multi-turn coils in series, as shown in Fig. 15. In order to obtain a rugged structure with the dimensional stability required when fixtures mount and hold the parts to be heated, the individual coils can be wound separately and mounted on and connected by buses. In this case, care must be exercised to keep water or brazing flux used in the production process and alloy away from the buses lest short circuits develop.

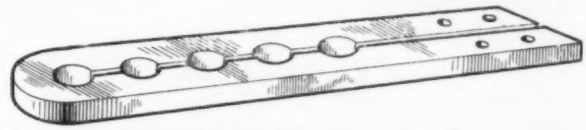
When the heat is to be confined to relatively small areas of the piece, a coil machined from sheet or bus, ¼ in. or more thick, will probably be found most practicable. Such a coil is shown in Fig. 16. Cooling must be provided for such coils. As before, this can be



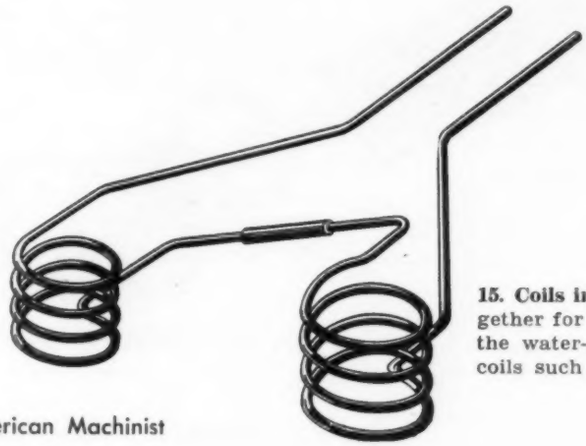
13. Coils for internal heating can be wound on a form (such as this one) made from pipe. Leads must be kept close together



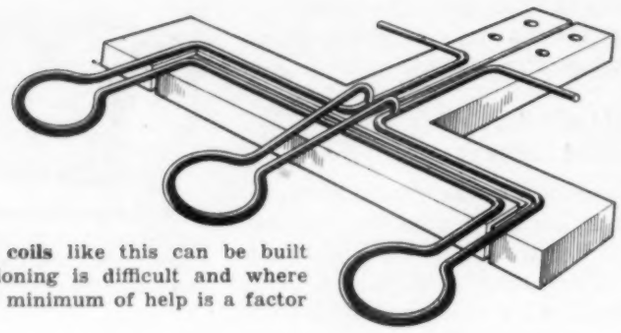
14. The spiral type of pancake coil is to be preferred. Coils should be wound tightly and with uniform spacing. These coils normally have cool spots where the leads are bent away



16. A simple multiple-position coil, made from copper bus, drilled and sawed. For cooling, copper tubing is brazed to the outside edge of the coil



15. Coils in series can be wound singly and brazed together for simplicity. Care must be exercised to keep the water-cooling path free on long, small-diameter coils such as this



17. Series-parallel coils like this can be built where work-positioning is difficult and where production with a minimum of help is a factor

accomplished by means of a milled water channel or tubing brazed (not soldered) on the periphery of the coil and buses.

Coils can also be connected in parallel or series-parallel combinations. A great deal of experimentation is often required to obtain the desired heat patterns and heating rates in the various positions, as the heating in each position is dependent on conditions in the other coils. In spite of the difficulties that might be encountered in working out the designs, these types of coil hold sufficient promise in results to be achieved to warrant consideration. The coil in Fig. 17 was designed and built to braze two thin tubes and one heavy coupling to a base in one operation. The coils for the thin tubes are in series and have long leads, while the coil for the heavy coupling has short leads and is connected in parallel with the two series-connected coils. Fine adjustment of heating rates can be accomplished by altering the spacing between coil leads, particularly on the coil for the heavy coupling. Spreading the leads of this coil will slow up the heating rate of the heavy sections and simultaneously increase the rate for the thin tubes. The converse is also true.

Handling Irregular Surfaces

Any sharp edges or irregularities which may be in the field will tend to overheat or even burn. The simplest types such as the ends of stock and regular sharp edges may be handled by controlling the coupling, with the coil coupling less to the sharp edges than the regular sections, as in Fig. 18a.

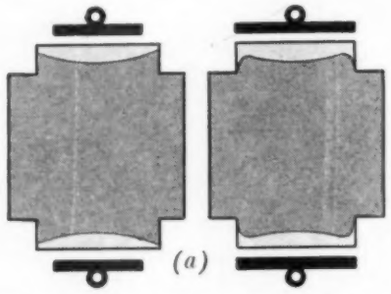
Where a surface is interrupted by a sharp edge such as a keyway, hole, or slot, the heat may be evened out by forcing a piece of copper in the workpiece before it is inserted in the coil as shown in Fig. 18b, thus short-circuiting the area.

Start with Right Tools

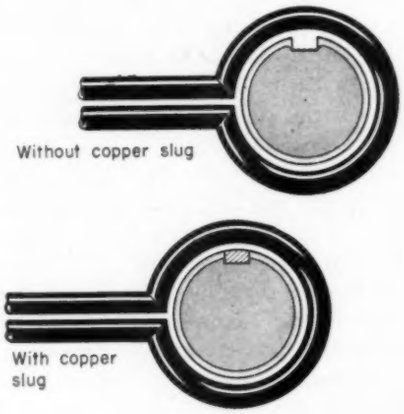
Coil building is still a skill, and both the right tools and men who know how to use them are important. Patience, creative ability, and practice will develop a man skilled and quick in making coils.

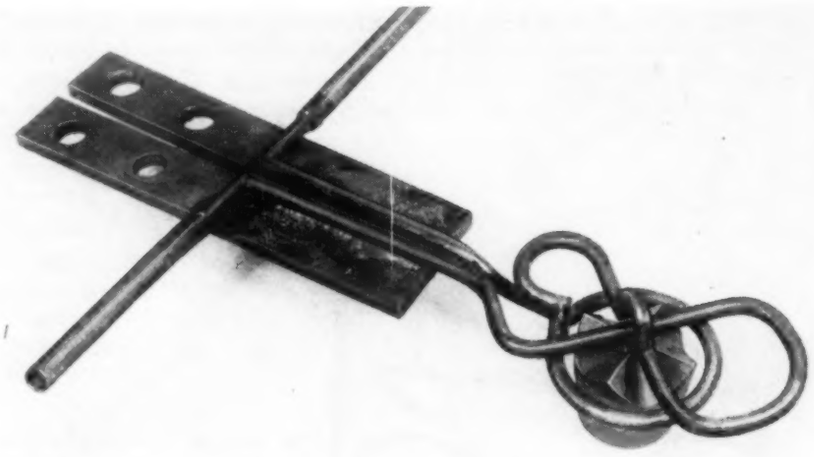
The usual hand tools available in every plant cover the requirements pretty well. Flaring and cutting tools for tubing are essential. A bench vise with copper jaw inserts, compressed air facilities, oxyacetylene torch with a wide range of tip sizes, and a water quenching tank should be provided. For making the final coils from bus copper, a bandsaw, jigsaw, drillpress, lathe, milling machine, and shaper will be helpful.

Annealed copper tubing should be used in all coil construction. If the tubing is not thoroughly annealed when purchased, it can be annealed by heating the copper to 1,000 F. and plunging immediately into cold water. It may even be advisable to reanneal complex coils in the middle of the winding process if the copper becomes work-hardened. Care must be taken to



18. Controlling the coupling, with the coil coupling less to the sharp edges than the regular sections, is shown in *a*. Where a surface is interrupted by a sharp edge, the heat may be evened out by forcing a piece of copper in the workpiece before it is inserted in the coil, as at *b*, to short-circuit the area





19. This interesting series coil provides the right amount of heat to heat-treat the cutting edges of a rock bit

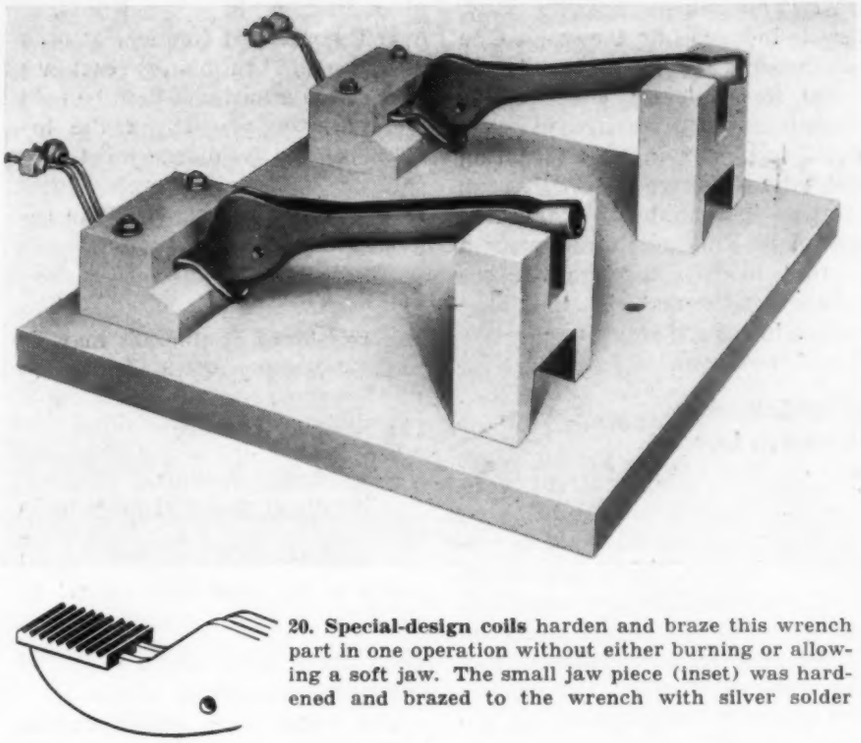
prevent the tubing from collapsing, especially where sharp bends are to be made. Where possible, brazed mitered joints are preferred. Where this is not practical, small-radius turns can be made, using the filled tube method.

In this method the inner surface of the tubing is coated with a light lubricating oil, after which it is placed in a pan of warm water and brought to a temperature of 180 F. or higher. The tube is then filled with molten low-temperature alloy, such as Wood's metal or Cerro-Bend. Quenching the filled tube in cold water will solidify the alloy. The tubing can then be bent into any configuration without danger of collapsing. Before using the coil, be sure the alloy has been melted out by placing the coil in boiling water. Rectangular tubing should invariably be formed by the filled-tube method.

All joints should be brazed with high-temperature material such as the silver solders which have high strength and good electrical properties. Soft solder is usually unsatisfactory because its melting point and mechanical strength are low.

The problem of brazing two miter joints which are very close to each other often arises in practice. To keep the first braze from remelting while the second joint is being done, several possibilities are open. The two joints can be done at the same time. Or the whole assembly can be rigidly clamped during brazing. Another method which is used at times is to leave part of the tubing stock uncut, filing a deep notch almost all the way through the tubing for the inside edges of the miter. The thin wall section will support the joint during brazing.

Avoid using excessive flux or brazing alloy. Have the joint surfaces clean, smooth, and very tight fitting. Watch the coil closely while working and avoid slipshod preparation. After brazing and filing, the coil can be pickled in an acid bath, and blown out, ready to test.



20. Special-design coils harden and braze this wrench part in one operation without either burning or allowing a soft jaw. The small jaw piece (inset) was hardened and brazed to the wrench with silver solder

WORK COIL DESIGN although based on experience, originates in theory

INDUCTION heaters are now becoming so common that many plant or industrial engineers need to know how to design the proper work coil for a given job. Some of the equipment manufacturers have had this in mind for several years, having made changes in their machines to make them adaptable to the many different applications within the power rating of the machine.

Work Coil Is Important Link

Because the work coil is the link between the generator and the work itself, the characteristics of the unit are important. As has been brought out before, the design should be such that many simple coils will load the machine readily. There are different ways to do this, for example a self-contained transformer with low-impedance, tuned output, or an external transformer. Because a self-contained transformer provides the most universal method, and one with the least adjustment required, we will use such a unit in our examples.

In a typical heater utilizing a self-contained transformer, separate output circuits are provided for both series and parallel connections to obtain the best match for both high- and low-impedance work coils. The general design principles outlined here, however, are applicable to all machines, although the mechanics of coil construction may vary. The work coil, itself, is considered as that portion of the coil adjacent to the workpiece.

In heating by induction, there

are two possible methods by which heat is induced into the work. One of these is explained easily in terms of I^2R losses, called eddy-current losses. When a piece of metal is placed in an alternating magnetic field we know that an electric potential is generated within it. This potential causes a current to flow through the resistance of the material, thus producing losses and resulting in heating of the metal.

Effect Caused by Hysteresis Loss

Besides the eddy-current loss, magnetic metals are also heated by hysteresis loss. It is not as important as the losses caused by eddy currents. The hysteresis loss is the amount of energy absorbed in the material as the lines of flux are changed. The loss depends on the material being heated by the coil.

Two variables are controlled with the design of the work coil. The first of these is the selective feature of induction heating. By proper design of the coil, it is possible to effect different temperatures in different parts of the same piece, regardless of their cross-section. This is possible with the right coil, as shown in a typical example in Fig. 20.

The second variable that may be controlled by the design of the coil is the amount of power to be used or the rate at which the article is to be heated. Often rapid heating would be undesirable even when high production is required. In this case more pieces are heated simultaneously, thus meeting the requirements.

Characteristics of Coil

To get the optimum out of any induction heater, its impedance must match that of the load. The impedance of a coil is made up mostly of inductive reactance. The resistive component of the impedance is as small as possible because copper is used. Silver plating is used where necessary, because it has the lowest specific resistivity. The inductive reactance is directly proportional to the inductance of the coil and the frequency of oscillation. In other words, if over the range of frequencies used for induction heating, the reactance part of the impedance is to be held constant, the product of the inductance and frequency must be a constant. It is plain, therefore, that as the frequency increases the required inductance decreases.

Coil Resistance

The resistance of the coil may be found by applying this equation:

(1) $R = \frac{\rho l}{A}$ where

R = resistance in ohms
l = length of material or path in in.
ρ = specific resistivity of the metal
A = area of conducting metal in sq. in.

(See Table A for actual values of common conductors.)

The actual area which carries current is not the full cross-section of the coil. This phenomenon is the result of the skin effect. The current tends to follow the path of least inductance. The current that would flow on the inside of the conductor would cut more lines of force so would encounter more inductance than the current that is flowing on the outside of the conductor.

Coil Inductance

As we are making a coil which will necessitate a multiplicity of turns, we must consider the effect this will have on the coil inductance. Adjacent conductors carrying current in opposite directions will cause a redistribution of current on the conductor surface. Because of this, theoretical evaluation of the inductance of a coil is very complicated, but it can be found by means of the empirical equation.[1]

(2) $L = \frac{a^2N^2}{9a + 10b}$ where

L = inductance in microhenries
a = outside radius in in.
b = projected length of winding in in.
N = number of turns

It can be shown that at 450 kilocycles, for instance, it is possible that the inductance of the leads themselves can become much greater than the work coil, especially if they are long or spaced some distance apart. This is a very important fact to remember.

Characteristics of Load

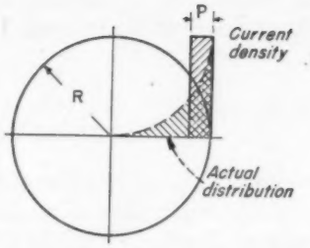
Let us now look at the load itself: In essence all the different types of loads may be grouped into three general types: ferrous or magnetic loads; nonmagnetic, high-resistance loads; and nonmagnetic, low-resistance loads. Copper, for instance, is nonmagnetic, and has a low resistance; brass or silver would also fall in this group. Under nonmagnetic, but high-resistance-metals, we would place any magnetic material after it has reached the curie point in temperature, and nonmagnetic stainless steels. In the magnetic group, of course, are all of the metals which exhibit magnetic properties.

In analyzing the heat induced in the metal by eddy currents, we must consider skin effect. Current density in the work is actually dis-

Table A—PENETRATION FACTORS

(At 450-kc. frequency)

METAL	RESISTIVITY ρ	PERMEABILITY (μ)	P in inches	SPECIFIC HEAT
Silver	1.63×10^{-6}	1	2.68×10^{-3}	0.056
Copper	1.72×10^{-6}	1	2.71×10^{-3}	0.0921
Brass	7.00×10^{-6}	1	5.46×10^{-3}	0.092
Stainless Steel	$40.\times10^{-6}$	25	2.60×10^{-3}	0.115
Iron	97.8×10^{-6}	500	9.14×10^{-4}	0.161
Steel	45.7×10^{-6}	1000	4.40×10^{-4}	0.118



21. Skin effect and depth "P" for a solid conductor. Current-distribution curve is much steeper at radio frequencies; thus thin-wall tubing is adequate and provides a passage for cooling water

tributed as shown by the exponential curve in Fig. 21. The area under this curve represents the total current which flows in the piece. Mathematically, a much simpler method of using this curve has been devised. The depth to which the current would flow if its density were constant is called penetration factor and is given by this formula:

$$(3)\quad P = 3560\sqrt{\frac{\rho}{f\mu}}$$

where P = depth in centimeters
ρ = resistivity of material in ohm-centimeters
f = frequency in cycles per second
μ = magnetic permeability of metal

Or in inches:

$$(4)\quad P = 1400\sqrt{\frac{\rho}{f\mu}}$$

Table A will give the penetration factors for the different metals calculated at 450-kc. frequency.

Current Path In Load Itself

Another point may be applied to all loads presented to the heater, the path of the current in the load itself. It has been explained that the current will flow next to the surface and a quantitative formula has been given. This alone does not completely define this path. When we think of a transformer, we think of a primary and a secondary and this secondary is connected to an outside load. Transformer theory shows that not all of the load is external, but there are losses in the secondary windings themselves. The loss is easily located and defined. It is in the wire itself.

In the load of an induction heater we know that the current which is induced in the load by the work coil has a continuous path. To simplify analysis, each turn of the work coil can be considered to be matched with the equivalent of a turn on the work. Each of these turns in the work is shortcircuited. When the turns are close enough the result will be a single-turn coil having a width equal to the projected length of the work coil. With this in mind, we can now figure the inductance and resistance of the work itself.

Load Resistance and Inductance

The resistive component of the impedance of the work may be calculated with Equation (1) whether it be magnetic or nonmagnetic. In the workpiece, the width of the path is taken as the total projected length of the work coil. The length of this turn is the circumference of the piece. And, of course, the thickness is the depth shown in Table A.

The inductance presented by the nonmagnetic load can be calculated with Equation (2). We again use a single-turn coil with the same dimension as for the resistance calculations.

The inductance of a magnetic load is much more complicated. This inductance is given by the formula:

$$(5)\quad L = \frac{3.19\ N^2 \times 10^8}{\frac{l_i}{\mu a_i} + \frac{l_a}{a_a}}$$ where

L = inductance in henrys
N = number of turns
l_i = length in in. of magnetic circuit in iron
l_a = length in inches of magnetic circuit in air
μ = permeability of material
a_i = area of iron in sq. in.
a_a = area of air in sq. in.

In evaluating the unknowns in the above equation, we must make assumptions which in general will be reasonably accurate. Assume that the flux penetrates only to the depth which shows heat. The magnetic path then must have the same cross-section as the current-carrying portion, as shown by the skin-depth calculations. The length of this path must be equal to the length of the heated portion or the projected length of the work coil. The length of the air gap will be approximately the same, and the cross-section may be assumed to be equal to twice the cross-section presented by the work.[2]

Mutual Inductance

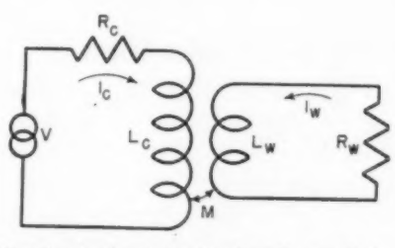
When the work is placed in the work coil the mutual inductance must be defined. We know that

$$(6)\quad M = K\sqrt{L_c L_w}$$ where
M = mutual inductance
K = coefficient of coupling
L_c = inductance of coil
L_w = inductance of work

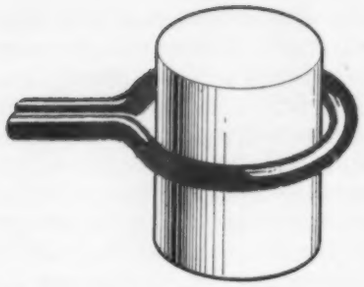
The coefficient of coupling, K, is the ratio of the flux that couples both the work coil and the work, to the total flux. In induction heating, the coefficient should be kept as high as possible. This depends upon the spacing and is usually kept above 0.8.

As the characteristics of heaters in general are not within the scope of this discussion, we must figure the characteristics of the work coil and work as if it were looking into a constant voltage. Actually none of the machines available provide constant voltage. In practice, however, this is not important and it would be impractical and uneconomical to provide it.

The equivalent load circuit is shown in Fig. 22. The work coil is represented as an inductance L_c connected in series with the work-coil resistance R_c and the output voltage of the generator V. By the



22. Equivalent load circuit used in designing work coils. L_c is the coil inductance, L_w the work inductance, and R_w the work resistance



23. Clearance between plug, representing work, and work coil in this typical application is approximately ⅛ in.

use of Kirchhoff's laws, impedance equations may be derived. In the work coil loop:

$$(7)\quad V = \left[R_c + j\omega L_c\right] I_c + j\omega M I_w$$

And around the work loop:

$$(8)\quad j\omega M I_c + \left[R_w + j\omega L_w\right] I_w = 0$$

All of the symbols have been explained except:

$$\omega = 2\pi f$$

where ω = frequency in radians per second
f = frequency in cycles per second

The impedance looking into the work coil:

$$(9)\quad Z = \frac{V}{I_c} = R_c + \frac{(\omega M)^2 R_w}{(R_w)^2 + (j\omega L_w)^2} + j\omega\left[L_c - \frac{(\omega M)^2 L_w}{(R_w)^2 + (\omega L_w)^2}\right]$$

The equation shows the effect the load has upon the impedance. As the resistance of the load increases, the total resistance increases since R_w is much less than L_w. As the inductance of the load increases, the total inductance increases, or approaches L_c as a limit.

Actual Design Calculations

The design of work coils can be made easier by using the formula given here as a guide. The exact evaluation of some of these formulas is impossible without becoming involved. Many assumptions must be made before an answer can be derived. Then each step would have to be retraced, changing each value to discover the effect on the whole.

Resistance losses of the average single-turn coil have been found to be about twice that of a conductor of similar cross-section. This gives us the multiple of 0.5 in the equation below. On multi-turn coils the reduction factor may vary somewhat from this value.

Determining coil characteristics is now practicable. Let us take a single-turn coil of ⅜-in. copper tubing with a 2⅛-in. inside diameter (Fig. 23). With the respective formulas:

From Equation (1)

$$R_c = \frac{(1.72\times10^{-6})\ (2.125)\ (\pi)}{(0.5\times0.375)\ (\pi)\ (2.70+10^{-3})}$$

$$= 7.24\times10^{-3}\ \text{ohms}$$

The resistivity and depth of penetration were taken from the table.

The inductance of a given coil can be calculated using Equation (2).

$$L_c = \frac{(1.44)^2\ \ (1)^2}{(9)\ (1.44)+(10)\ (0.375)}$$

$$= 0.124\ \text{microhenrys}$$

or 1.24×10^{-7} henrys

Calculating impedance of the workpiece is more difficult. As long as the material is nonmagnetic, the problem is not serious. Consider a copper slug 2 in. in outside diameter. Using values from the table:

$$R_w = \frac{(1.72\times10^{-6})\ (2\times\pi)}{(0.375)\ (2.70\times10^{-3})}$$

$$= 1.07\times10^{-2}\ \text{ohms}$$

$$L_w = \frac{(1)}{(9)+(10\times0.375)}$$

$$= 0.0784\ \text{microhenrys}$$

The mutual inductance between the work coil and work when K is assumed to be 0.8.

$$M = 0.8\ \sqrt{0.124\times0.0784}$$

$$= 0.0789\ \text{microhenrys}$$

Solution of the impedance equation (9) gives

$$Z = 0.0182 + j\,0.128\ \text{ohms}$$

If we assume an output voltage of 150 volts, we may solve for the current flowing in the load circuit:

$$I_c = \frac{V}{Z}$$

$$= 1.63\times10^{2} - j\,1.15\times10^{3}\ \text{amp.}$$

It is interesting to note that current in the coil actually runs 1160 amps.

$$P = VI_c = 150\times1.63\times10^{2}$$

$$= 24{,}400\ \text{watts}$$

We can also calculate the power actually absorbed in the work by first solving for I_w in Equation (8), then substituting:

$$I_w = 2.18\times10^{2} + j\ 1.14\times10^{3}\ \text{amp.}$$

The voltage appearing across the load would then be

$$V_w = I_w\ (R_w\ j\ L_w) = -2.33 + j\,12.2\ \text{volts}$$

By multiplying the voltage across the work by the conjugate of the current, the actual power in the work is found:

$$VA = P + jP_x$$
$$= V_w\ (\text{conjugate } I_w)$$
$$= 14{,}400\ \text{watts}$$

Therefore the efficiency of this coil would be

$$\frac{14{,}400\ \times\ 100}{24{,}400} = 59\%$$

This value is typical for a copper load. By closer coupling, thus increasing the K factor, efficiency would be increased, but the work-handling problem would be greatly increased, because exact centering of the work in the coil at high production speeds is often difficult.

An examination of Equation (5) will show why it is impractical to make a theoretical determination of the inductance of a magnetic load. It is almost impossible to calculate the length and area of the flux paths in a magnetic workpiece and in the near vicinity. Where necessary, it is possible to measure the inductance of the piece beforehand with the proper equipment. However, most coil design today has developed from experience, with the equations outlined here as a guide.

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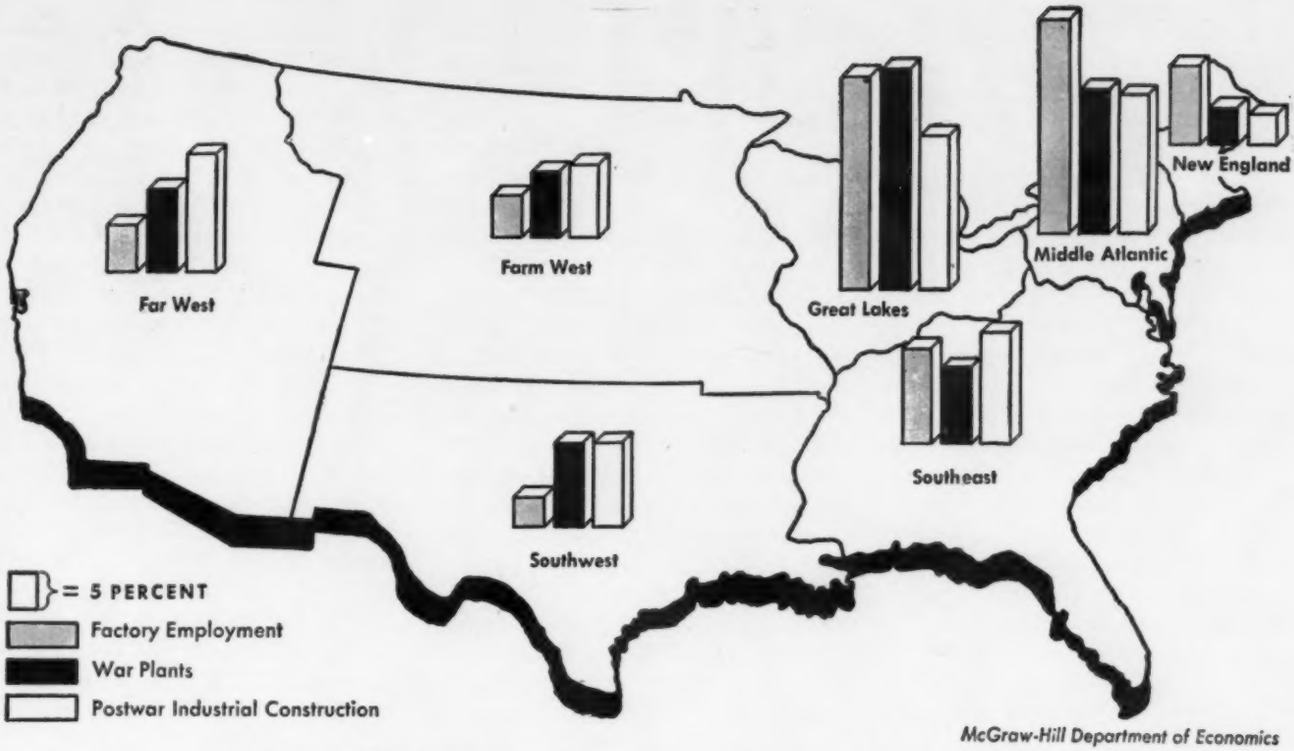
(1) Equations numbered (2) and (5) have been derived and are accurate only for work at low frequencies. So many additional factors must be added that the equation becomes unwieldy when working at high frequencies. However, the equations are valuable for rough calculation.

(2) The proof for the assumption is quite lengthy. It is based on the effect the work coil has upon the flux distribution.



Faster and Faster... U.S. industrial migration Speeds Up. The West and South gain even larger shares of new industrial construction than they did in World War II

Is Metalworking Moving?

American industry is speeding its march to the West and South, but Metalworking, more concentrated initially, is moving only half as fast . . . A just-completed special study

AMERICAN industry is speeding its march to the West and the South, mostly the Far West and the Southwest. These areas are gaining new industrial centers faster than in World War II.

During the war, Atlanta, Dallas, Kansas City, Des Moines and farm-belt towns suddenly grew industrially. Hampton Roads, Charleston, Mobile and other sleepy southern ports began to roar with wartime shipbuilding. The Pacific Coast swelled with new aircraft plants and shipyards. New steel mills arose at Houston, Los Angeles and Salt Lake City.

But postwar construction shatters the wartime record in the West and the South. This important point is revealed by a study made by *American Machinist*, in cooperation with the McGraw-Hill Department of Economics.

One-half of all of today's new plants are going up in the South and West. Before the war, those areas had little more than one-fourth of all plants. The New England, Middle Atlantic and Great Lakes States got only 55% of the new wartime plants; and they are getting only 45% of the new plants now.

When current expansion is completed a year from now, the nation's factory capacity will have been boosted 50%. In about a decade, the expansion in the South and West will have been almost 100%. The northeast regions, by comparison, will have gained only one-third. In other words, putting one-half of the country's over-all gain in industry into the South and West has made these "new" regions grow almost three times as fast as the old ones.

Metalworking has not moved quite as rapidly as industry as a whole or as non-metalworking industries. For one thing, Metalworking (except for transportation equipment plants) has been more concentrated all along. Based on employment figures, the migration of all industry to the South and West has amounted to about 6% since 1939. But the bigger metalworking industries—steel prod-

ucts, machinery, electrical machinery, automobiles—made smaller shifts of around 2½% in the case of the first three named and ½% in the latter.

While Metalworking appears on the surface to be sticking in the older areas, the increases in jobs tell dramatically the story of the inevitable (if glacial) movement westward and southward. The gain since 1939 in the new regions is 150%. For the entire nation it is 90%. For the "old" regions it is 83%. Thus the new regions have increased Metalworking jobs twice as fast as the old regions.

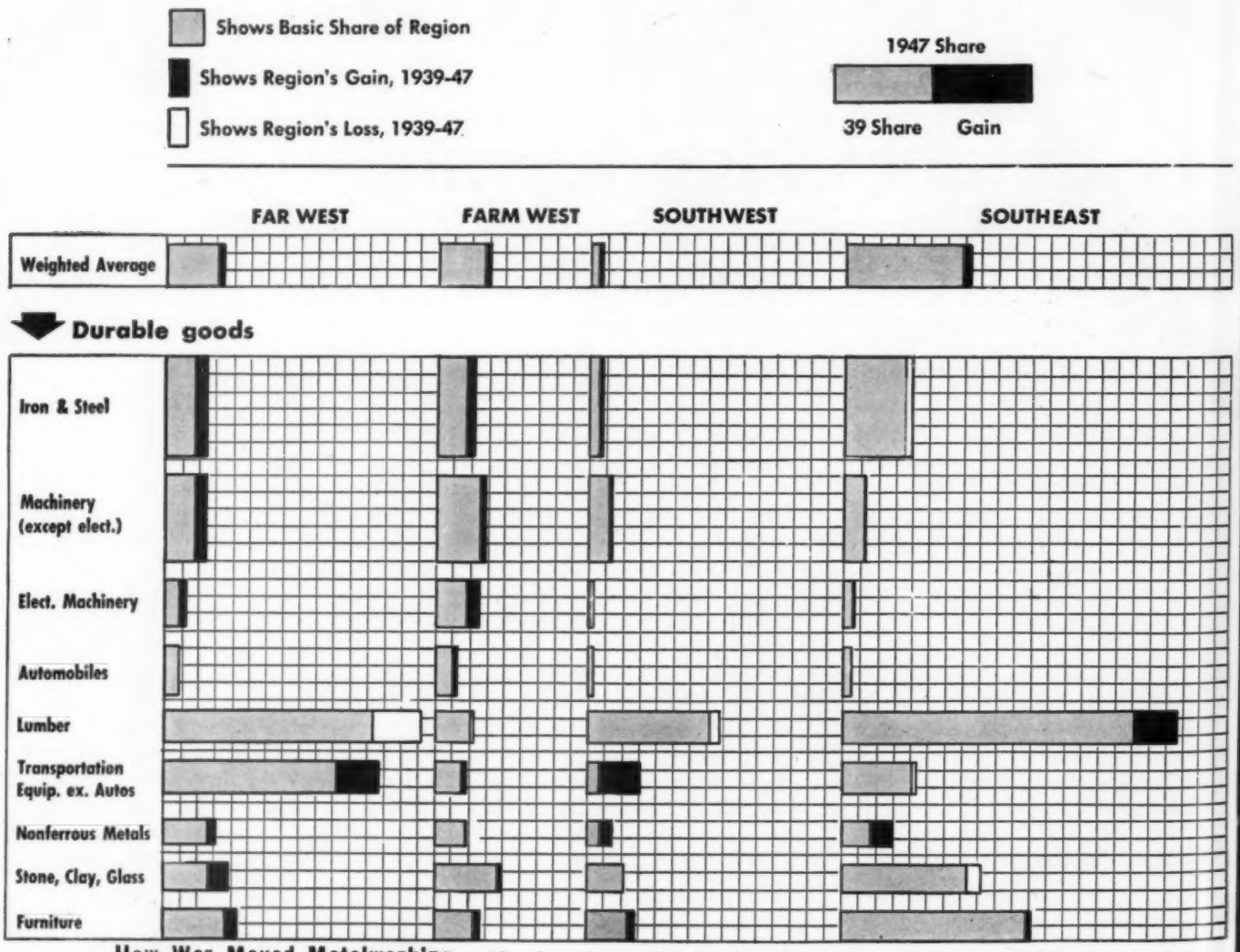
Another point worth noting: Much of the increase in old regions came with existing capacity. In the new regions it came mainly from new capacity.

In Metalworking, the Far West made the broadest advance. For proof, take a look at the growth of the aircraft, shipbuilding and automobile industries on the West Coast. California now boasts that it is second only to Michigan in assembly of automobiles. Today that state has 17 car assembly plants, eight of them at Los Angeles.

The Far West and the Southwest were next in order of metalworking gains. The New England and Mid-Atlantic regions gained a bit in automobiles and in machinery building. Great Lakes rose in steel products and non-ferrous metals, while losing in others. The Southeast made the poorest showing of all.

Probably the most dramatic story is the shift in the automobile industry. In 1939, 83% of auto-plant jobs were in the Great Lakes states; the 1949 census will probably show still close to 80% there. But, while the industry's heart still is in Detroit, production is spread all over the U. S. map. It now is operating 113 assembly plants in 77 cities of 24 states. Ford has set out deliberately to spend money on the Pacific Coast in purchases of car parts. It wants to get up to a minimum of $50 million a year out there, and already has attained a $27-million-a-year level. That program means West Coast jobs for a lot of people.

Machinery plants, which have more than doubled jobs since 1939, have shown little tendency to migrate. The South and West have gained—especially the Far West—but so has the Middle Atlantic region. New England and the Great Lakes States have lost 1 to 2% of their shares, but 85% of machinery-making jobs are still in the



How War Moved Metalworking... The durable-goods industries (5 out of 8 make up Metalworking) are moving

Northeast, half of them in the Great Lakes region. In other words, these plants have not migrated as did their customers.

Like iron and steel fabricating, machinery plants are dependent on steel, which is concentrated in the Northeast. If the basing-point system disappears permanently, such plants will tend to cluster about assured sources of supply. Iron and steel fabricating has actually increased in the Great Lakes and New England states, declined in the Southeast.

Electrical machinery hasn't moved much either. The Great Lakes region has lost 3%, Middle Atlantic has stayed even, New England has gained. Far West jobs in such plants have quintupled, but 91% of the jobs in these plants are still in New England.

Mid-Atlantic and New England states lost 11% of their prewar share of transportation-equipment manufacture; the Far West and Southwest gained 10%. Result: The Far West, with 26%, is pushing the Middle Atlantic with 31%.

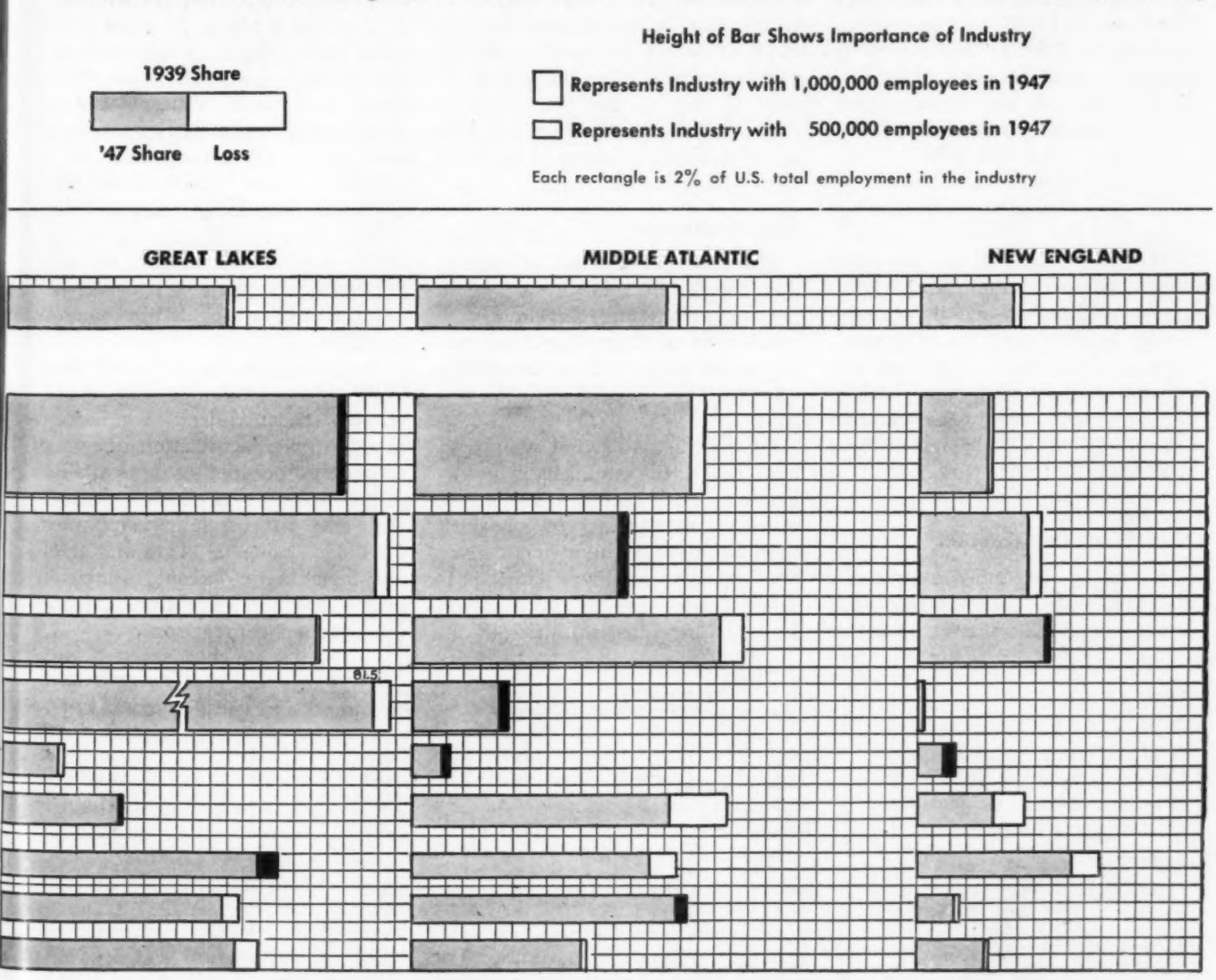
Non-ferrous metals plants moved west and south—but stayed east of the Mississippi. Mid-Atlantic and New England each lost 3½% of their prewar shares; the Great Lakes and Southeast gained 2½% each, while regions west picked up only 2% altogether.

Labor's Movement

Even with half of the war and postwar construction, the South and West will make only a small gain in their proportions of all U.S. factory workers. With 10½ million more persons employed in the U.S. since the war, the civilian labor force in the West had increased about 1¼ million, or 20%. In the Northeast area, labor force increased about the national average of 8.6%, while in the South generally it held even, according to the Bureau of the Census.

As an interesting sidelight, it might be mentioned that increases in employment of women were relatively much larger than of men in every region and 32.6% vs. 19.7% for the nation as a whole. However, the female labor force in the West increased about 39%, as compared with 17% for males. In the Northeast, the rate of increase of female workers was six times that for males—accounting for half the total increase in women workers.

Most recent analyses of employment shifts since 1939 indicate a 3% shift from the Northeast to the South and West. This 3% is really


1939 Share
'47 Share
Loss
Height of Bar Shows Importance of Industry
Represents Industry with 1,000,000 employees in 1947
Represents Industry with 500,000 employees in 1947
Each rectangle is 2% of U.S. total employment in the industry
GREAT LAKES
MIDDLE ATLANTIC
NEW ENGLAND
BLS

West and South. Here are shown gains and losses between 1939 and an average of October, 1947, and April, 1948

assessable to wartime only, because figures are a year or so old. An estimate based on construction shows the eventual shift as nearer 6 or 7%.

A dozen years of accelerated migration will raise the share of the South and West of all factory workers from 28 to about 35% of the national total. But, in rounded percentages, they will have only about 18% of the workers on iron and steel products, 17% of those on machinery, 9% of those on electrical machinery, 7% of those on auto production, 44% of those on transportation equipment, 19% of those working on non-ferrous metals.

Thus, Metalworking as a whole is 84% in the three northeastern regions, only 16% in the four southern and western ones, as compared with a 60-40 break for all other manufacturing. The break on income is 57-43, and in population 48-52. In short, industry in general, and Metalworking in particular, are far more centralized than income or population.

Metalworking will probably remain centralized longer than other industry, judging by these figures, although the percentage growth in the new areas will become more and more spectacular. Elimination of basing points—if it sticks—would tend to slow the migration, because materials suppliers are concentrated in the same areas. Lower freight rates in the West, on the other hand, and the shift in consumer markets, would tend to accelerate migration.

New Plant Construction

Migration and new plant construction are, incidentally, not synonymous. When new and better equipment goes into an old plant—usually the cheaper solution today—there is no migration; where old plants are abandoned for new in another area, migration moves on the double. During the war, almost $10 billion was spent on plant construction; since then about $5 billion. But many wartime plants can't or won't be converted and postwar construction has a year at least to run, so our best guess is that postwar construction will add about as much permanent capacity as did wartime building.

Decentralization

Migration is strictly, of course, the transfer of a large part of an industry from one section of the country to another. But American figures on migration are inevitably affected by decentralization as well.

In contrast to what you may have heard, the emphasis is on migration, not decentralization—in other words, industry in general is tending more to movement from one region to another than it is to move from large to small towns. The 20 top industrial cities of the nation have gained 45% since 1939 in the number of factory jobs; the rest of the nation has gained 50%.

These averages do not jibe with actual studies of decentralization. The National Industrial Conference Board reported, for example, that 148 companies, which had 47% of their plants in cities with more than 100,000 people prewar, are putting only 34% of their plants into the big cities. Facts on geography and statistics explain the difference. The move to smaller cities is stronger in some lines, like electrical machinery, than it is in others, like steelmaking with its heavy investment. Also, in reporting employment, small towns close to big cities are included in the city statistics.

The NICB study indicated that 59% of the companies studied are already decentralized—frequently as a result of acquisition of going companies or surplus war plants rather than of deliberate policy. But one out of four companies have such policies. (Iron and steel and machinery, except electrical, plants are the exceptions.) Here are detailed comparisons:

DECENTRALIZATION ARGUMENTS

PRO	CON
1. Taps new labor sources	1. Skilled and/or trained labor is in recognized centers
2. Cost savings through new layouts, better materials flow, methods, machinery, in new plant.	2. Integrated plant is more efficient
3. Cuts distribution costs	3. Cuts supply costs
4. Smaller plant improves labor and human relations, efficiency	4. Centralized management permits closer coordination
5. Avoids traffic and parking problems	5. Better shipping and shopping facilities
6. Permits segregation of unlike operations in separate plants	6. No need to duplicate large or costly facilities
7. Cyclical or seasonal variations absorbed by extraneous occupations	7. Nationwide collective bargaining nullifies labor cost savings
8. National defense	8. New plants cost more than expansion

1940-47	ALL INDUSTRY	ELECTRICAL MACHINERY	OTHER MACHINERY	NONFERROUS PRODUCTS	IRON & STEEL & PRODUCTS	TRANSPORTATION EQUIPMENT
Total new plants	408	77	28	20	61	29
To cities under 10,000, %	29.4	28.6	28.6	50.0	21.3	44.8
To cities 10-100,000, %	36.3	40.3	39.3	30.0	42.6	27.6
To cities over 100,000, %	34.3	31.2	32.1	20.0	36.1	27.6
Before 1940						
Total new plants	846	189	48	23	94	96
To cities under 10,000, %	21.3	14.3	16.7	13.1	11.7	21.9
To cities 10-100,000, %	31.7	33.9	37.5	30.4	27.7	33.3
To cities over 100,000, %	47.0	51.9	45.8	56.5	60.6	44.8
Companies reporting	148	14	20	10	15	16

TALKING SHOP

Father of Invention

YOU'VE HEARD the old saw that "Necessity is the mother of Invention." Jerry Reich of the Reich-Huntington Iron Works, a small-shop owner who must make his dollars have more cents, adds this ". . . and Imagination is the father." He maintains that Imagination will provide an economical solution to many problems, proves it by using non-orthodox methods to get orthodox results at minimum cost. Example: A sausage-stuffer, laid on its side on wheels riding a channel and pinned at any 12-in. interval, makes a gage for shearing strip to ⅛-in. tolerance. The old stuffer gear train sets the rack plunger as closely as you wish.

Zipped Air Duct

COMMERCIAL-PLANE trend to utilize the exhaust from reciprocating engines to drive gas turbines, thus compounding power delivery, means new developments in materials and machining.

In one case, fiber glass and neoprene laminate forms a shroud to confine the air stream for cooling cylinders. This material can be cut like cloth, is flexible and easy to fabricate. Zippers permit the shroud to be folded back for servicing.

Cooler

TO COOL the extrusion plunger on the big tube-extrusion press at the Huntington, W. Va., plant of International Nickel, they use a shroud with an airline connection. As the plunger is withdrawn, the metal shroud is set over it and the air turned on. After a minute or so, the plunger is cool enough for relubrication.

Infrared

OLDSMOBILE engineers are developing a new machine to assemble aluminum-alloy pistons and con rods. Piston pins, a tight fit in pistons, are pre-heated by infrared in an oven, while pistons are held at temperature by resistance units. General principles are like those described previously (*A.M.*, April 8).

Rx for Absenteeism

ONE BIG RAILWAY-CAR SHOP, plagued by postwar absenteeism, got its union to accept a clause in the new contract granting a bonus of 3 cents per hour for perfect attendance in any 40-hr. week. While this represented only $1.20 per week over a basic $65, it cut absenteeism in half. The plant manager now hopes to increase the bonus, because his day's output—particularly on Monday—is directly dependent upon the number of substitutions required.

Solder Gun

SEVEN SECONDS is the heating time of a new electric "solder gun" developed in England. The secret is a special transformer, which steps down main power supply to 1/3 volt. The secondary transformer winding leads out to become a holder for the induction-heated tip. The gun weighs 2½ lb., costs about $16, is suitable for electrical and radio connection work.

Natural Alloy

SOME of International Nickel Co.'s ore deposits in the Sudbury Basin of Canada contain nickel and copper in 2:1 proportion. Initial worry was a cheap way to separate the two. Finally, one of the men came up with a startling suggestion: Why separate them at all, when the two in that proportion made an alloy of excellent properties? INCO tested, found he was right; here was a "natural alloy." They named the alloy after the suggestor; his name was Monel.

Woodpeckers

SUBMERGED-ARC WELDERS are testing reclamation, grinding and reuse of the flux. If mixed with a "'reasonable" proportion of new flux, it seems to do its twin jobs of picking up impurities and preventing absorption of nitrogen and oxygen compounds from the air. One fabricator has recently been reported to be using all reclaimed flux.

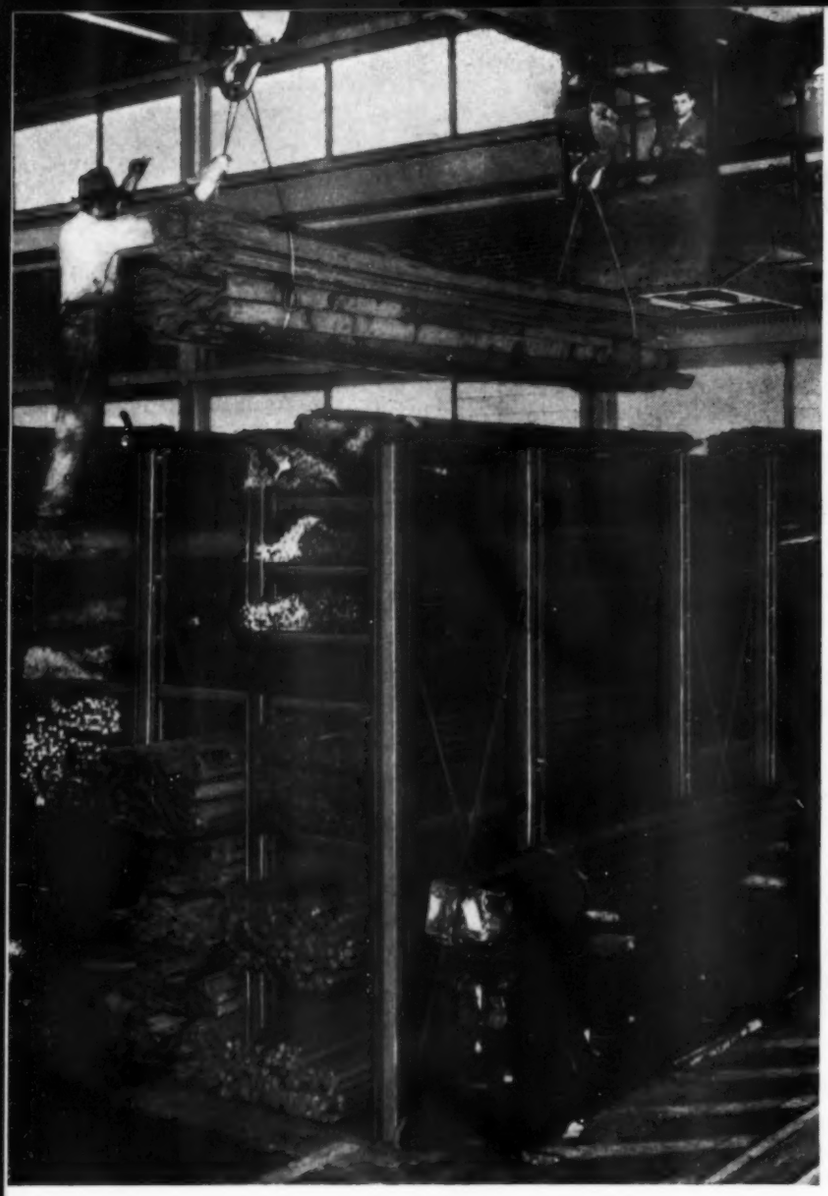
Reminds us of the story of the chicken raiser who began to add worthless sawdust to his chicken feed. When 25% sawdust caused no trouble, he stepped up to 50%, then 75% . . . with real savings. Not yet content, he went to 100% sawdust, and stuck out his chest at his astuteness. But when the next batch of eggs hatched, all the chicks were woodpeckers.

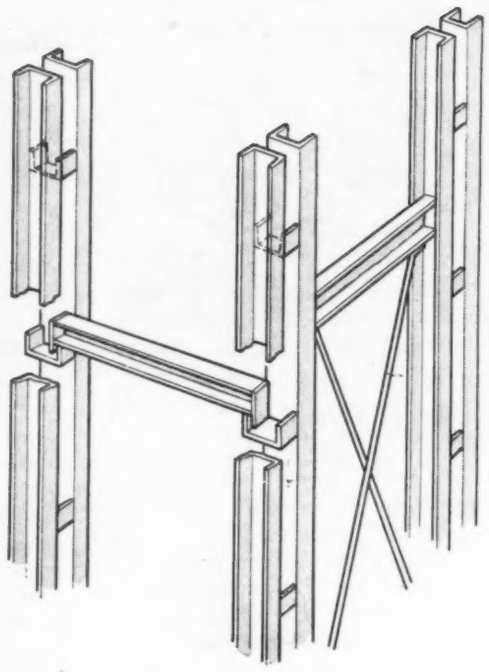
One-Hoss Shay Design

BIG WEAR PROBLEM with coal cars is not erosion or mistreatment; it's corrosion. Coal dust lodges in crannies, forms the equivalent of sulphuric acid with rain water. So a coal car's life is a direct function of the number of lodging places inside for dust.

"Running" repairs—brake system, wheels, etc.—are unavoidable and relatively inexpensive, but major repairs are costly. Coal cars first had ¼-in. sides and floor. The floor system had a life of 10 years or so, sides 12 to 13 years; so two major repair jobs were required just a couple of years apart, involving many of the same rivets. To get sides and floors on the same schedule, railroads shifted to 3/16-in. sides. Objective was thus to produce a "one-hoss shay," all parts of which let go at once. Copper-bearing steel moved the whole schedule back 25%, welding is expected to push it back another 15 to 20%, making a car last perhaps 15 to 16 years.

"One-hoss shay" design could well be applied in other fields, balancing the working lives of major parts for longest life and lowest repair cost.





Storage racks with removable crossbars help keep lots of bar stock segregated in receiving warehouse. Crossbar position in channel support is clearly shown. Racks are made in two sections for easy movement if it becomes necessary to rearrange warehouse facilities

Racks and Bins Aid Raw-Material Warehousing

BY R. O. FRISTOE, PLANT ENGINEER, EWART PLANT, LINK-BELT COMPANY

WAREHOUSING of incoming raw materials can be a difficult, expensive problem. In our plant, a wide variety of steel bar stock plus coiled rod must be kept segregated in the warehouse, with easy access to each lot if production operations are not to be delayed. In addition, economic handling and effective utilization of space must be achieved.

Our solution to the problem features an overhead traveling bridge crane plus two special units that we designed for use with the crane. One is a storage rack for bar steel and the other is a stack bin for coiled rod stock.

Steel is received in open cars in bundles. The crane has two 5-ton hoists, operated individually or under single control, and can easily be hitched to the bundles. This gives us lower-cost handling not only in our own plant but also at the loading dock of the steel mill.

Bars are moved to and from the rack by crane and are stored in the horizontal position. The load is supported by crossbars that are removable to give access to lower sections of the rack. Crossbars rest on 2-in. channel sections welded on 1-ft. centers between the pairs of upright channels that form the posts of the rack. This construction enables adjustment of crossbars for different lot sizes, maximum spacing being a function of rack

design. Crossbars are positioned before placing each load of steel.

Each rack is made up of two sections. Each section is 8-ft. high, and has an over-all length of 20 ft. This length is divided into eight bays, each of which is 29½-in. on centers. The vertical posts of each section are tied together at the bottom with a heavy I-beam, notched at the top to clear the channels that form the posts. One channel is placed on each side of the web of the beam.

Width of the rack sections from the front to the rear post is 3-ft. 6-in. Channel sections in every other bay cross-connect the posts at the bottom and similar sections are specified for every bay at approximately two-thirds the height of the section. ⅝-in. diagonals cross-brace every other bay.

Two sections are placed parallel to one another, as shown in the picture, to make up one rack. Sections are positioned such that a 42-in. center distance is maintained between the four posts along each side. The rack shown is for bars 14-ft. long. Similar racks have been constructed for bars 10 and 12-ft. long.

Placed in the racks after physical and chemical tests, the steel is checked with the spark test and then identified by a color code painted on the exposed ends of each bar.

The stack bins evolved from the machine-shop practice of storing parts in stackable tote pans and boxes. Coiled rod stock, handled with lift trucks and stacked in rows on the warehouse floor, was reducing the storage capacity of the area considerably. To eliminate this, we made large welded steel boxes with a 15,000-lb. capacity, a 30 7/16-in. stacking height, and hooks on each corner so crane slings can be attached.

The bins are rectangular in shape, being 7½x10-ft. inside. Bottoms are 7/16-in. steel plates while sidewalls are of 3/16-in. plate. Corners and top edges are reinforced with 3x3x¼-in. steel angles welded in place. Crane hooks are formed from 1¼-in. dia. steel bar rod and reinforced with 1¼-in. thick steel bar on each leg. These hooks locate the boxes when storing one on top of the other.

Loaded with coils, bins are handled by the overhead crane and often are stacked six high. This helps keep the floor clear and small lots of stock separated.

Quitting Time or Washup Time?

By JAMES K. MATTER
Pioneer Engineering & Mfg. Co., Detroit

QUITTING time was 4:45 P.M., and at 4:44 P.M., the general manager and I were seated in his office, looking out into the deserted corridor. One minute later the quitting bell rang, and instantly the corridor was thronged with a hurrying, jostling crowd of workers, men and women with hats and wraps on, all washed and groomed for the street.

The general manager's mouth was drawn into an unpleasant curve. "There do not go the future officers of this company," he remarked.

His attitude is typical of that held by most employers. They say, and with justice, "We pay those people, and pay them well, for eight hours' work. We want what we pay for."

As a foreman, superintendent, works manager, I've spent years trying to keep men working until the whistle blows. I can claim no great success. On the whole, I've been satisfied; the men did a good day's work—but a lot of them did insist on washing up before the whistle blew.

A cleanup period of two or three minutes is only more waste time, as most workers simply make the cleanup time their new quitting time and are washed up by then. There are some, of course, who will work until the whistle blows before putting away their tools and washing up, but they are exceptions.

In some plants, the washroom is kept locked for the last half hour, and opened only when the whistle blows. This would seem to be foolproof, but the men take water in cans and pails to their machines and wash up there.

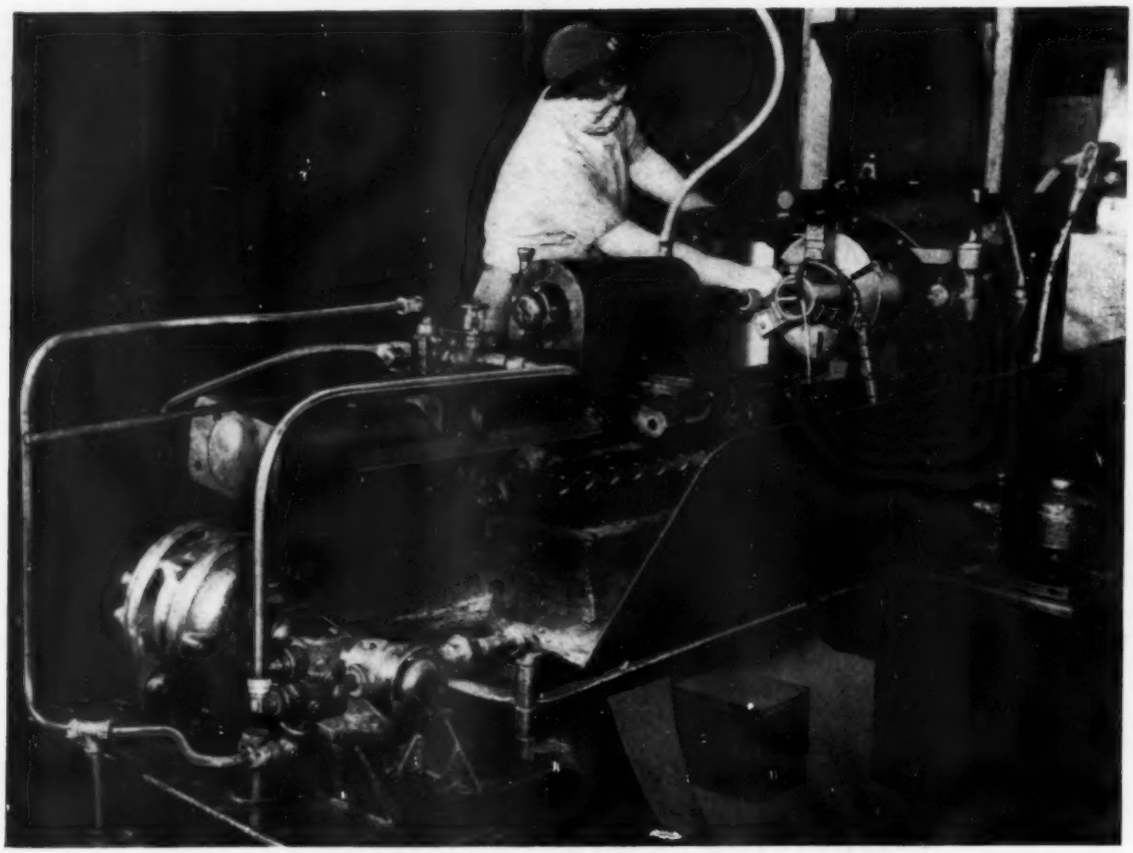
There are plants where the foremen are required to be out on the floor for the last half hour of the day to prevent early quitting. Foremen consider this as police work and refuse to see too much.

The fact of the matter is that the practice of taking a washup cut is bred pretty deeply into American workers. Rightly or wrongly, they consider quitting time as going-home time—and they go.

There is perhaps another side to the problem. My friend, the general manager, is shaved every day in the company barber shop on company time. He, and most office workers, have their dental work done on company time, they attend to other personal duties on company time. Yes, it is true, they are on salary.

The shop men know all about this. They don't expect to be paid for time spent in barber shops or dental chairs, and if they have some personal business to attend to they expect to be docked for the time off. But they do feel, and feel strongly, that whistle time is going-home time, not washup time.

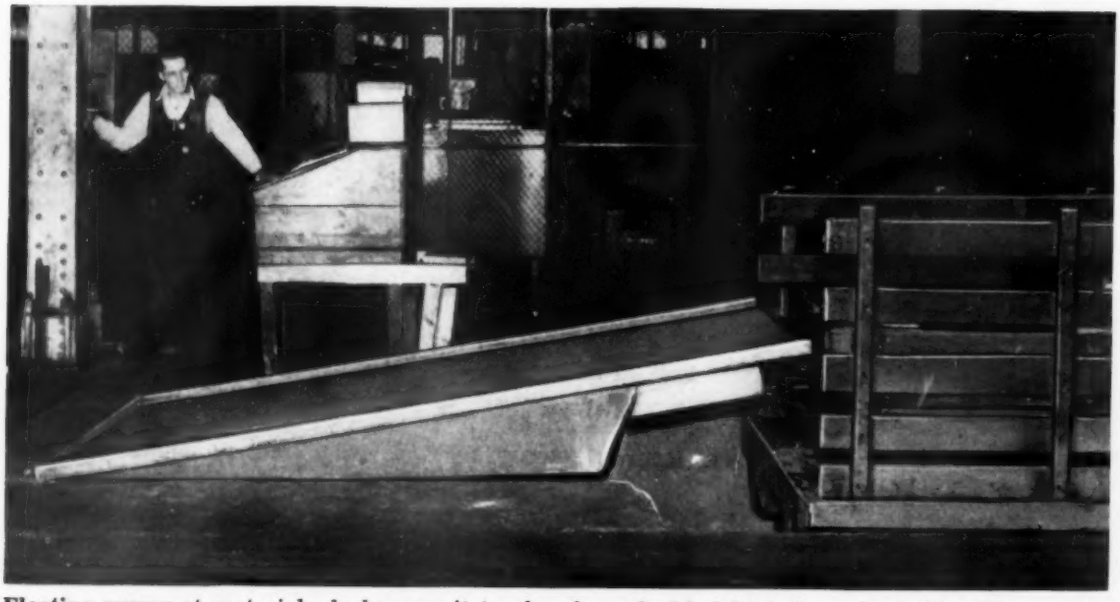
There is far less trouble with early quitting if workers are on bonus or piecework, and it has always seemed expedient to me to put as much work as possible on this basis. The problem of keeping day workers working right up to the whistle is a problem I cheerfully leave to the younger generation. We never licked it.



Converted turret lathe finish grinds I.D.'s of hardened-steel tractor bushings. Hydraulic cylinder between bed ways reciprocates 7½-hp. Fay & Eagan grinder on special carriage. Power is provided by Allis-Chalmers motor and Vickers pump mounted on welded steel tank

SHOP SHOTS

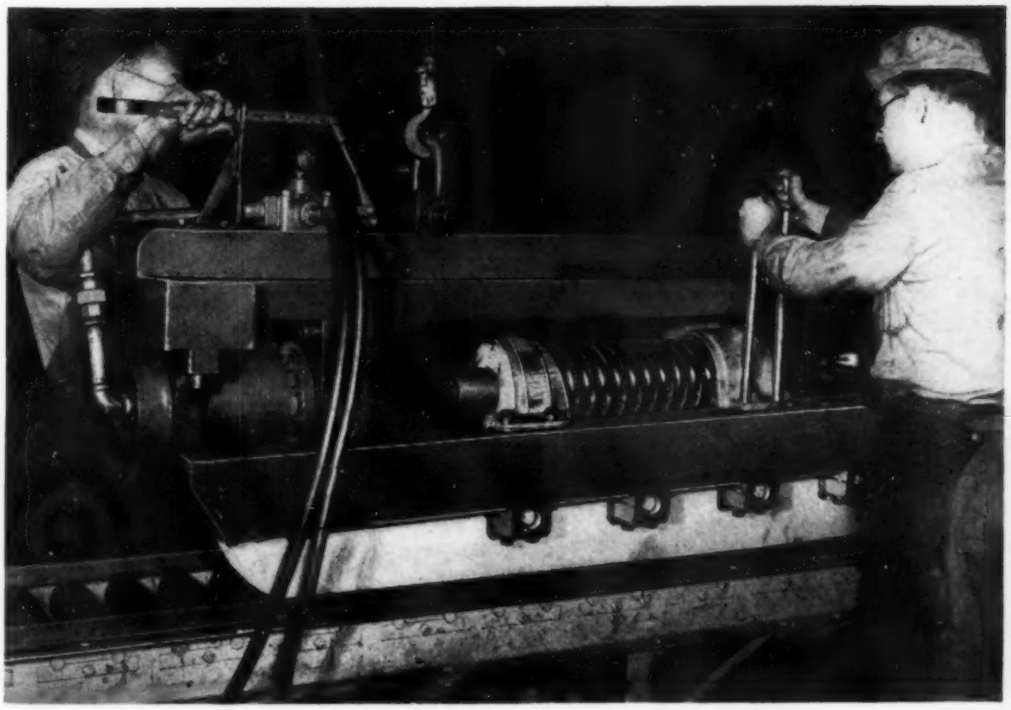
AT SPRINGFIELD WORKS, ALLIS-CHALMERS



Floating ramps at materials docks permit trucks of any bed height to be unloaded by lift trucks. Air cylinder raises hinged ramp, truck is backed into position and ramp is lowered to rest on edge of truck bed. Cylinder is located in well under ramp

Fixture base in place of turret on lathe carriage holds cast-iron track-release housing for crawler tractor. Lathe head rotates rose reamer for rough cut, boring bar for finishing 2¾-in. hole. Fixture plate and tools for three models may be mounted in turn

Three-wheeled lubrication cart moves six tanks and hand pumps and various special oils, solvents and greases around plant for scheduled oiling. Machine lubrication points are identified by numbered disks for type of oil and frequency of servicing



Portable hydraulic fixture compresses track-release spring for assembly to crawler-tractor truck. Lever-operated four-way valve on top of fixture controls 10-ton cylinder to align holes in side bar and housing. The 550-lb. fixture is supported by a floor-controlled hoist over conveyor

Resistance Welder Makes Cutoff Machine

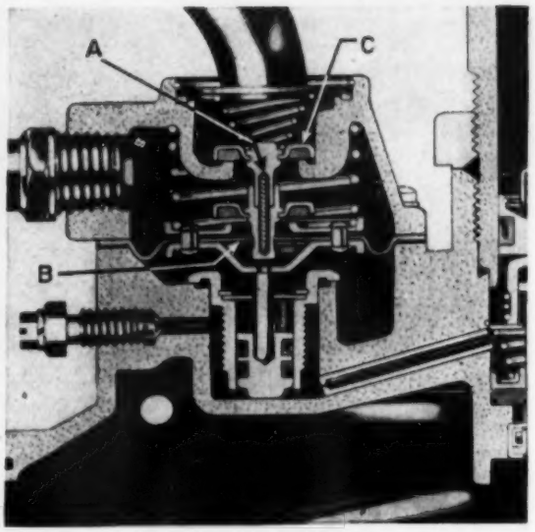
Rebuilt unit melts off short sections of wire cable for use as flexible valve stems in power cylinder controls

BY LESTER TINGLEY, PROCESS ENGINEER,
BENDIX PRODUCTS DIV. BENDIX AVIATION CORP.

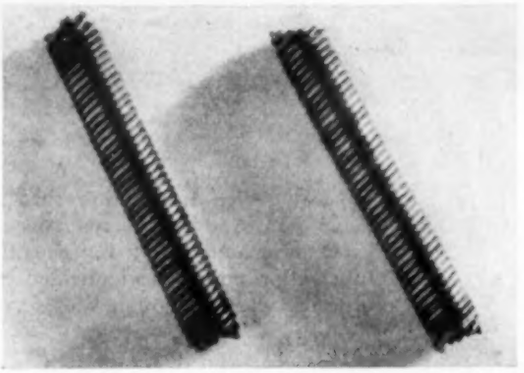
DIAPHRAGM-operated poppet valves which control Hydrovac power cylinders have a novel stem made from flexible steel cable. Either 1.025- or 0.835-in. long stems are cut from 0.128-in. dia. cable automatically at a rate of almost 800 per hr. in a special machine which also welds the ends so the cable will not unwind.

Separation of the individual stems from the reel of cable actually is an operation involving the melting of a short length of the cable and then applying tension to pull the cable apart, rather than an actual cutting operation. The cable is clamped in the jaws of an electric resistance heater and current is applied to bring the short section of cable between the jaws up to melting temperature.

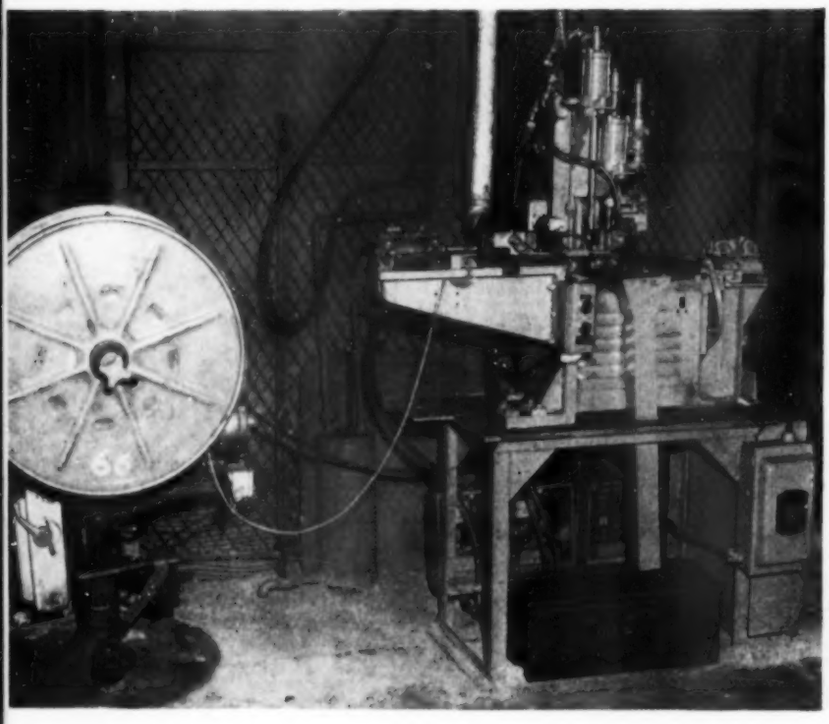
Electronic timers control the length of time heating current is applied, so the entire cycle of the machine can be made automatic. Details of the machine, and of the grinder used to finish the ends of the stems, are shown in illustrations.



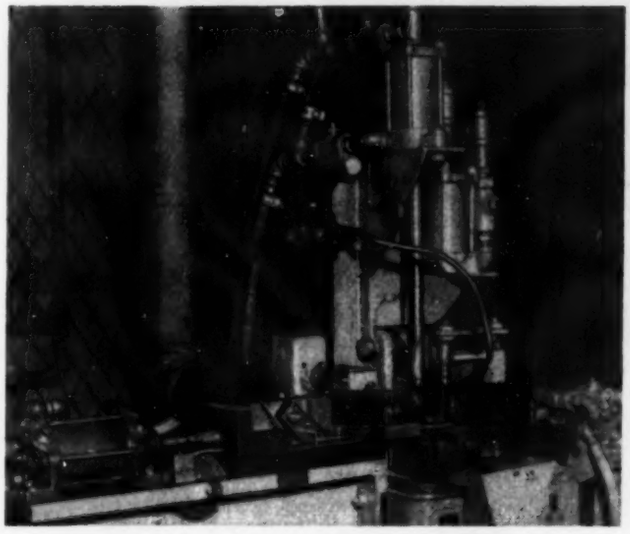
Flexible valve stem ***A*** **in Hydrovac power-brake unit connects control diaphragm** ***B*** **with poppet valve** ***C***. **It is cut from standard 0.128-in. dia. flexible steel speedometer cable with special machine. Stem must be flexible to insure proper seating of valve in closed position**



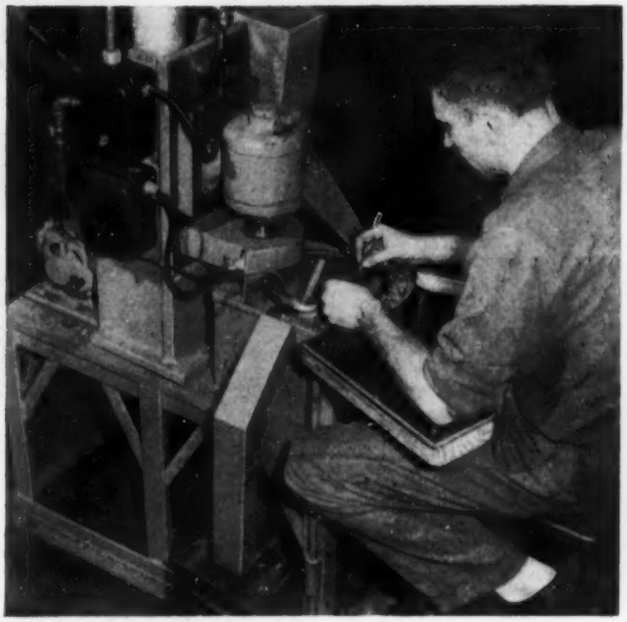
Cable valve stems are fused at each end to prevent loosening of turns at same time that they are separated from the stock by special machine. Length is 1.025 or 0.835 in., as produced on cutoff machine. Secondary operation completes stems by grinding to length



Small resistance welder rebuilt by Bendix engineers for automatic production of flexible valve stems from steel cable. Motor-driven reel stand feeds cable through control switch to prevent loop from touching floor while maintaining enough loop to eliminate drag. Four air cylinders on cutoff machine are controlled by solenoid valves actuated by limit switches and electronic heat-control timer. Operating rate is adjustable between 700 and 1100 pieces per hr.; best operating conditions are obtained when rate is about 780 per hr.



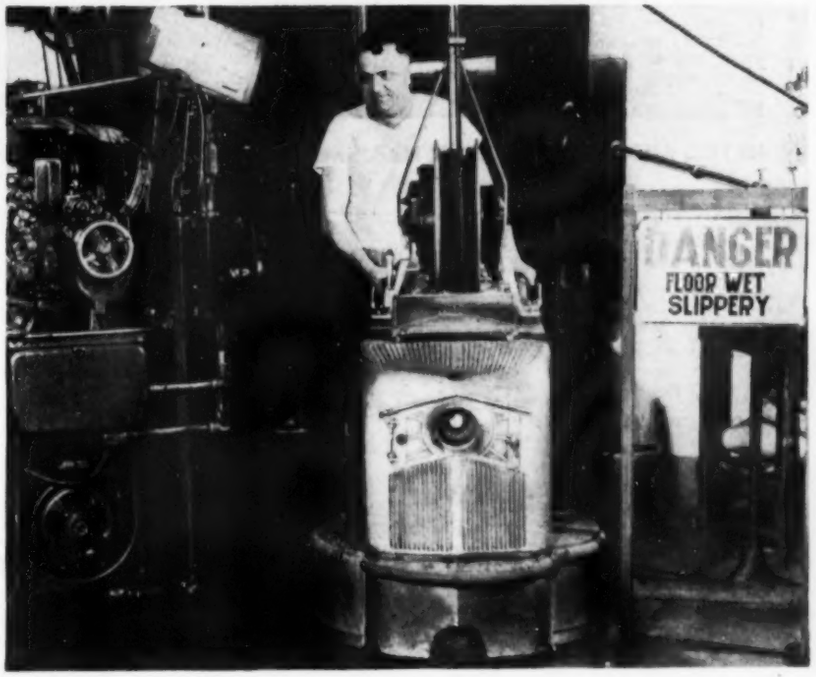
In automatic cycle, left-hand air cylinder moves slide to feed cable into clamp jaws. When slide contacts Microswitch, two vertical air cylinders clamp jaws onto cable. Right-hand clamp cylinder operates Microswitch at bottom of stroke to start heating cycle. Heating is achieved by passing current through cable between jaws. At end of heating cycle, section between jaws is at fusion temperature. Then, third solenoid valve operates air cylinder to move right-hand jaws 0.020 in. to right, breaking off stem section. At end of cycle all cylinders return to original positions and automatically initiate another cycle. Feeding cable into jaws pushes finished part into chute



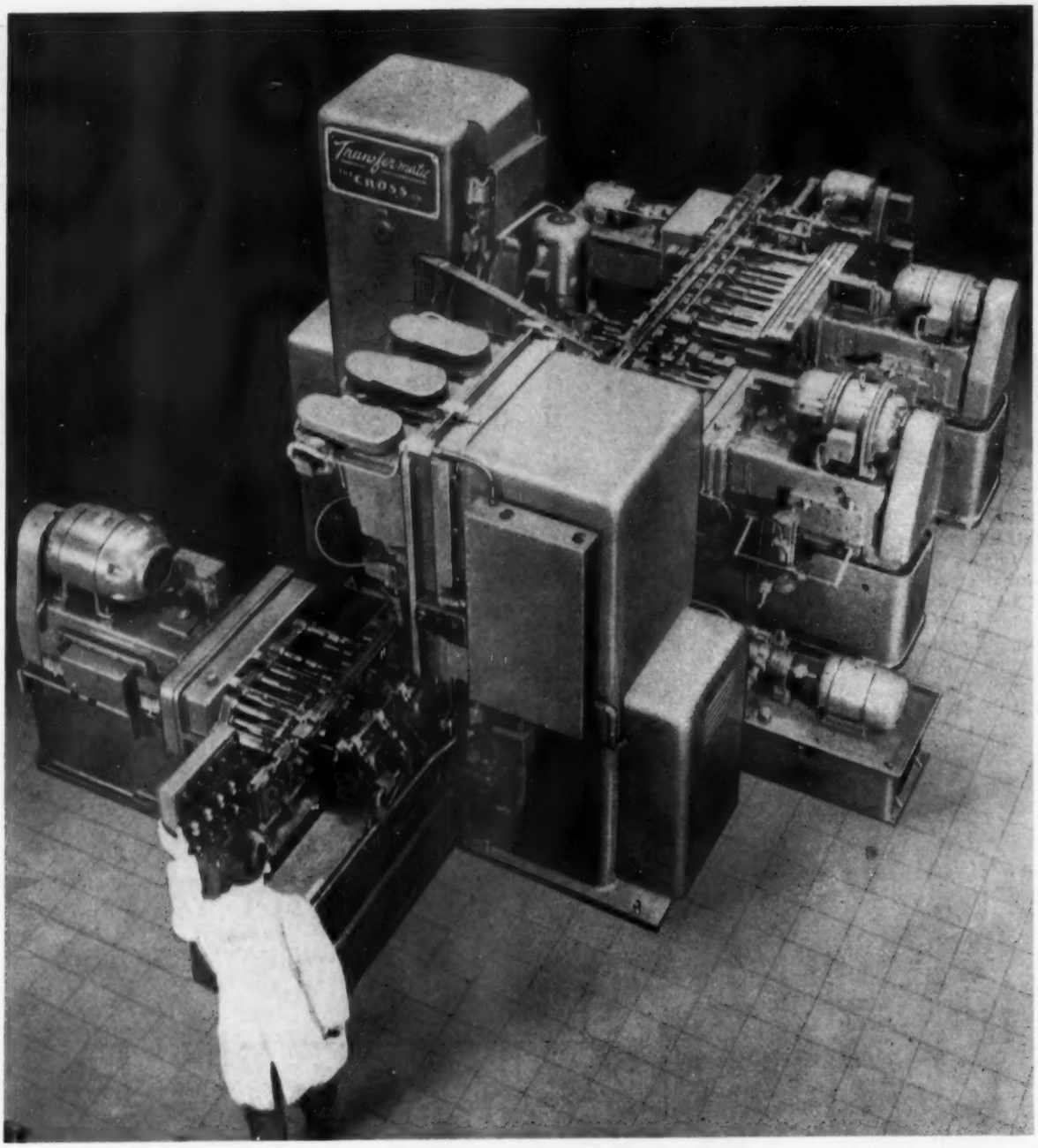
High-speed vertical grinder with continuously rotating dial table was developed by Bendix for grinding flexible valve stems to length within ± 0.0125 in. The 6-in. dia. cup wheel is driven at 3600 rpm. by ¼ hp. vertical motor on adjustable slide. Table is 10 in. in dia., has 12 dial positions, each with a hardened steel bushing which holds stem vertically as it passes under grinding wheel. Stems drop from bushings as they pass over chute opening in machine base. Slot in table is for wheel dresser.

MACHINE-SHOP SAFETY PRACTICES REDUCE LOST HOURS

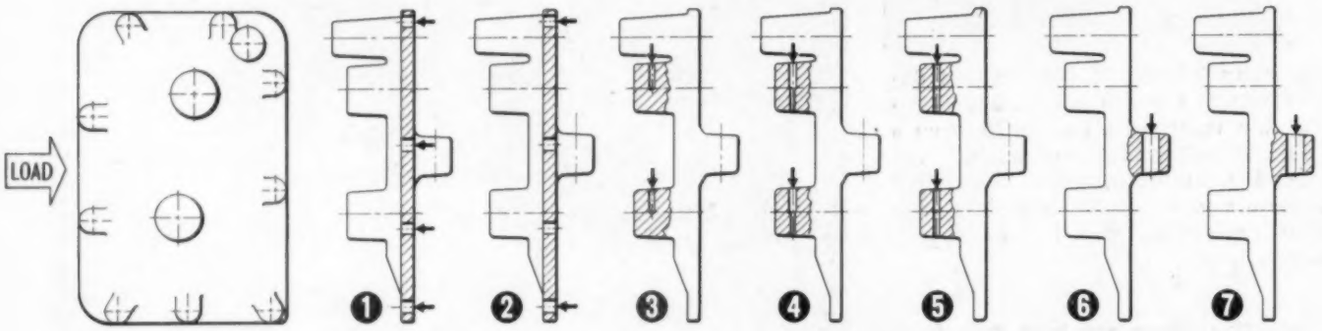
Reporting injuries to the first-aid department is a sound policy, but workers' first reaction to cuts is to wrap a soiled handkerchief or wiping rag around it. Sterile towels in convenient boxes are provided by Eastman Kodak in all departments to reduce the chance of infection



Production floors are kept free from dangerous oil slick in Eastman Kodak's Camera Works. Here a scrubbing-machine operator cleans floor in screw-machine department. Portable danger signs warn of slippery floors



IN THIS AUTOMATIC TRANSFER MACHINE THE HOUSINGS GO THROUGH 14 OPERATIONS SHOWN IN THE

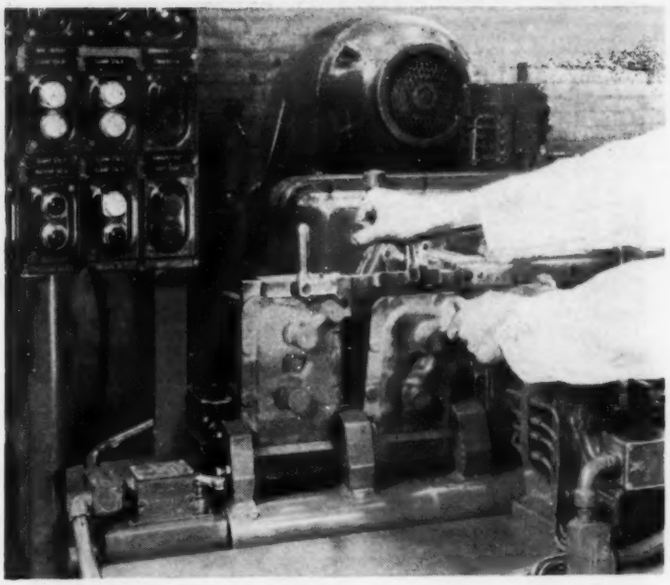


SEQUENCE OF OPERATIONS

1. Drill 9 holes in flange 11/32-in. dia.
2. Ream 2 dowel holes in the flange
3. Drill 2 holes 0.136-in. dia. for No. 0 taper pin half-way
4. Drill 2 holes 0.125-in. dia. for No. 0 taper pin, second half
5. Ream 2 holes for No. 0 taper pin
6. Drill one shifter-rod hole 0.593-in. dia.
7. Ream one shifter-rod hole 0.625-in. dia.
8. Drill 2 control-shaft holes 19/32-in. dia. half-way; drill

TRANSFER MACHINE WORKS IN DUPLICATE

Transmission gear-shift housings are produced faster in this automatic transfer machine by working on two housings at each station



Two parts are loaded between transfer fingers into upper and lower grooves at loading station

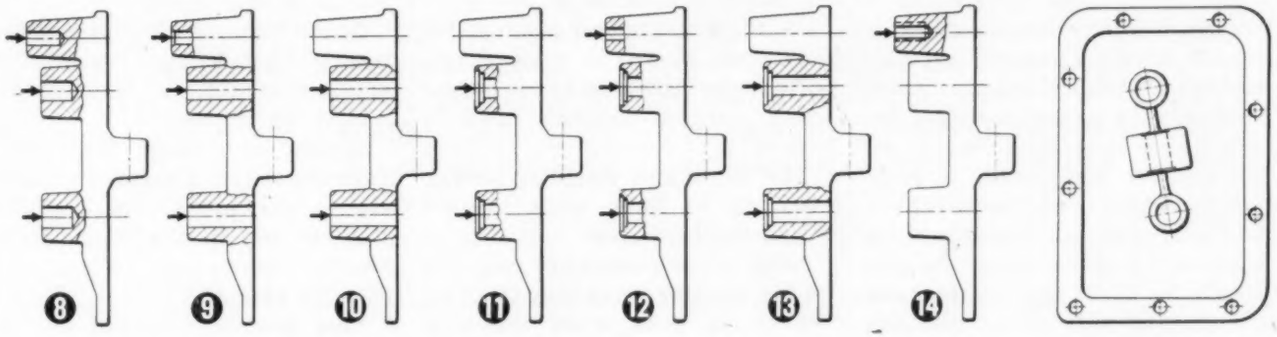
WORKHANDLING, now generally considered the best place to cut costs in machining, is at a minimum in transfer machines. An example of latest practice installed by one of the automotive companies is a machine built by the Cross Co. to perform 14 operations on 28 parts at once on transmission gear-shift housings.

This Transfer-matic produces 175 housings per hour at 80% efficiency. Only one operator is required and all he has to do is load the machine and press the control button.

Grooves at top and bottom of the fixture extend the length of the machine, and act as guides from beginning to end. They receive two parts at the loading station. Including these two, 30 housings are spaced and held in position by an equal number of fingers which are attached to a pivoting transfer bar also extending the length of the machine. When the bar moves forward, all parts advance one station. The bar then pivots on its axis, taking the fingers out of engagement with the parts, and returns to the starting position where the fingers rock back into engagement and are ready for two more parts. Danger of overtravel is eliminated since accurate location and clamping of the work

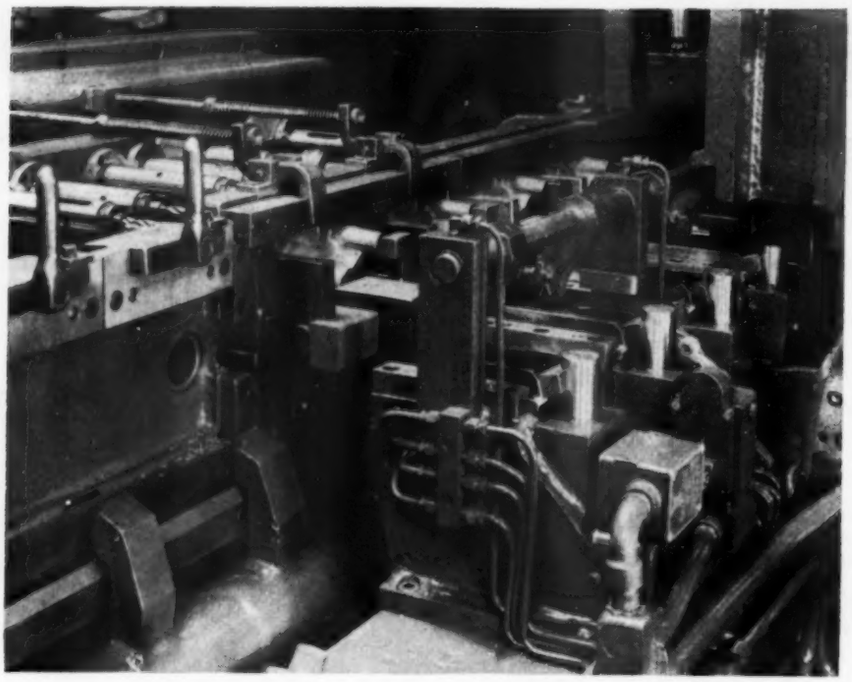
Completed housings in which drilling, reaming, boring, counterboring and tapping operations have been performed on the Transfer-matic

DRAWING. THIRTY HOUSINGS ARE IN THE MACHINE AT ONE TIME INCLUDING TWO AT THE LOADING STATION



control-arm screw hole for 7/16-14 tap

9. Drill 2 control-shaft holes 19/32-in. dia., second half and countersink one control-arm screw hole for 7/16-14 tap
10. Bore 2 control-shaft holes 0.622-in. dia.
11. Rough counterbore oil-seal seats and face bosses for 2 control-shaft holes
12. Finish counterbore oil-seal seats and finish face bosses for 2 control-shaft holes
13. Finish ream 2 control-shaft holes 0.625-in. dia.
14. Tap one control-arm screw hole 7/16-14



Workholding at station 1 holds parts against bottom edge by fingers at top. Plungers coming in from the side equalize stock longitudinally. Clamps holding parts against the mounting face are backed up with self-locking wedges

takes place before the fingers release the parts.

At the first station, final location is accomplished from the bottom and two side edges to insure proper positioning for the flange holes. Two dowel holes reamed in the second station are used for accurate location thereafter.

Clamping in each station is against the mounting face after the parts have been accurately located. In stations 1 through 8 and station 11, the clamps are strategically applied so as to back up the cut and prevent distortion of the work. The clamps for stations 1 through 8 are positioned simultaneously with a hydraulic cylinder working through a linkage. After positioning, a separate cylinder for each station operates a wedge lock which holds the clamps in position. Clamping in station 11 is handled similarly, but because of its location it is independent. In stations 9, 10, 12, 13 and 14, the parts are clamped with spring plungers operating with the motion of the drill heads. In station 15, the parts are held by a hydraulic cylinder.

Chips fall into a trough located directly below the transfer bar and are automatically conveyed to 4 outlets in the side of the base by paddles attached to the moving bar.

Another feature is the automatic tap cleaning and lubrication device. At the completion of each cycle, a blast of air is directed at each tap and a vaporizing device attached to the air supply introduces a small amount of oil into the air stream.

To simplify the design and provide flexibility for possible part changes, standard self-contained units have been utilized wherever possible. Three Cross No. 26 Hydraulic way-type feed units are used to rotate and feed the tools for Stations 1, 2, 8, 9, 11, 12 and 13. A modified No. 101 hydraulic way-type feed unit is used to feed the tools in Stations 6 and 7. Quill-type feed units of special design are used for stations 3, 4 and 5 and a special way-type boring unit is used for the boring operation in station 10. Tapping in station 15 is accomplished with a standard tapping head with individual lead screws for each spindle.

To reduce maintenance, all self-contained units are interchangeable and may be replaced without extended delays in production. Spindles, spindle bearings, gears, hydraulic and electrical equipment are standardized to reduce the inventory of repair parts. Electrical controls are centralized in a cabinet away from the machine. In the event of a cycle failure, signal lights on the control panel indicate where to look for the trouble.

Keep Your Dividing Head in Trim

THE MOST essential parts of a dividing head, the accurately hobbed bronze wheel and ground steel worm, are precision parts. Considering their vital function—locating the position of the spindle—it is amazing how much abuse they must absorb in some shops.

An important point to remember when using a dividing head is that—

The worm and wheel are *never* intended to hold work against thrust by themselves.

Even when cutters are centered on the work or when they straddle the work; even when the load *looks* balanced—it almost never is.

To keep chattering and other damaging loads from ruining the head—

Use a clamp.

A dividing head with backlash is a poor tool, if not a useless one. In the first place, it isn't accurate. In the second, a sudden excessive load may damage the teeth, even if the clamp is in position.

At the same time, turning a head that is tight is hard work. This practice should be followed for correct operation—

Loosen both worm and clamp. Take the required number of turns and division on the plate, and then seat the pin in the proper hole. Finally tighten the worm, and then the clamp.

This procedure should be followed without fail. It will keep the head in condition to do that for which it was designed—accurate dividing. *Lew Suverkrop, Bakersfield, Cal.*

ROUND TABLE

Blue Devils

"I just had a good one pulled on me, Al," laughed Ed. "I thought I had heard everything, but this one is a killer!"

"Like any other mystic you think I can get whatever you are driving at out of thin air," smiled Al. "Come to the point, Ed."

"Of all the excuses to get a day off! Look, Al, Bill Latreau's working along as usual, when about nine o'clock he comes to me with a cock-and-bull story about 'Blue Devils' bothering him."

"Blue Devils! What in the name of heaven are they?"

"Oh, that's a French-Canadian expression signifying that evil spirits are bothering you," explained Ed. "You know, when things go all wrong with a guy."

"I can readily sympathize with Bill. Haven't you had days like that, Ed? I know I have."

"Sure I have, but I stuck through and finally got them licked—the Blue Devils, I mean. I honestly think he's working for a day off for something else."

"Ed, if the man says that this is one of his off days, I certainly would give him the benefit of the doubt and send him on his way before anything serious happens," Al advised. "His coming to you and telling you was nothing more than obeying the little voice that told him he had better be getting out while the getting was good."

"Horsefeathers! Things like that were seriously considered in the days of the Puritans, but not in this day."

"Oh, yeah, Wise Guy! What about the time you rushed in and told me you might as well go home? You said that not a thing was going right with you that day."

"Maybe it was one of my off days," returned Ed. "I got over it by sticking on the job; didn't I?"

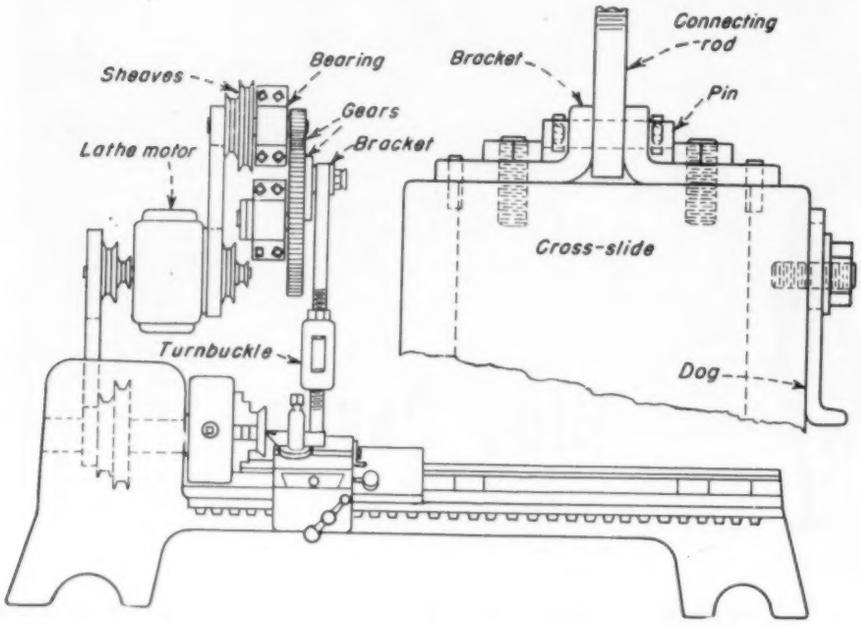
"But, Ed, Latreau's in a different position than you—you weren't handling machinery."

"So you still believe in Blue Devils, eh?" frowned Ed. "You think there are such things as evil spirits that make life miserable occasionally!"

"Ever hear of gremlins, Ed? These are the non-flying variety."

***ARE THERE** "days when everything goes wrong"? Should an operator who's having an off day be allowed to go home—or would off days suddenly increase in frequency as a result? What are your ideas or opinions; others will be interested. Discussions of earlier topics appear on later pages.*

Practical Ideas



Automatic Lathe Mechanism Faces Work with Rough and Finish Cuts

Facing small parts in a lathe that has no power crossfeed requires too much hand operation to be practical for most production jobs, but if this facing operation can be made automatic, the work can be done economically on an old machine.

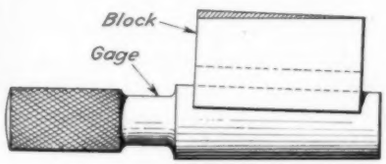
Operating power for the illustrated setup is taken from the countershaft of the lathe motor. The illustration is a compound view, showing the front of the lathe and the top of the mechanism.

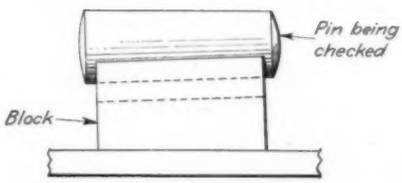
A sheave, two bearing brackets and a pinion and gear are mounted on a plate at the back of the lathe. The gears are mounted on stub shafts in the bearings. Two brackets clamp a T-bolt to the face of the driven gear through six screws into the gear. The brackets form a T-slot aligned in a radial direction on the gear, allowing the location of the bolt to be adjusted for length of slide stroke.

The connecting rod, adjusted for length with a turnbuckle, is bolted to the end of the cross-slide with brackets and a pin, as shown in the detail. The compound screw is removed from the cross-slide to permit free movement of the compound. Since the pull and push of the connecting rod is not always horizontal, the slide's gibs must be kept snug.

A spring-loaded switch on the cross-slide controls the motor, hence the operation of the mechanism. The circuit is arranged so that a main switch must be held down against the force of a spring to start the action. When the dog on the compound trips the spring switch near the start of the forward stroke, the main switch can be released, because the spring switch closes the power circuit. As the compound comes back on the return stroke the dog trips the switch back to its original position, cutting off motor current and stopping all action. For safety purposes, a simple toggle switch can be added to the line for power cutoff in case of misalignment or interference.

Because the linear motion of the compound is harmonic, the fastest feed is during the middle of both forward and back strokes, and this factor must be considered when adjusting the mechanism. Although the system could be used for light steel work, it is best for brass and bronze. Tool spring from the forward stroke allows a finishing cut on the return stroke if the tool is ground with minor back and side-rake angles.—*Ralph R. Waech, Tacoma, Wash.*



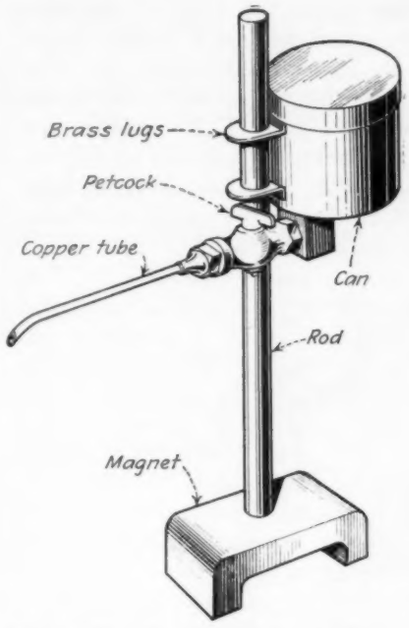


Block Bottom Surface Ground For Inspecting Tapered Parts

Taper gages come in many forms, but almost all are expensive to make, and most are difficult to machine with real precision. One way to check a taper on parts, which do not all have to be the same size, is to grind off the bottom of a V-block to such an angle that the work can be set in the block and compared with a dial indicator.

The block is set over a plug gage of the desired taper and locked in a vise on a surface grinder. The complete bottom surface of the block is ground flat and parallel to the bottom edge of the gage.

Assuming the V of the block is in good shape, any parts that are placed in the V after machining can be indicated with a dial indicator. The top surface of the part must be level.—*John H. Coyle, Fairfield, Conn.*



Magnet Stand Holds Oil Supply To Cool Jobs on Small Machines

A small oil-feeding mechanism, held to a machine surface by its magnetic base, can lubricate metal-cutting jobs on machines that have no built-in coolant system.

A small metal can—baking powder, tobacco, etc.—was fitted with two spring-brass lugs to hold it to a vertical stand in the magnet. A brass block was drilled to take a small petcock, and was soldered to the bottom of the can over a hole.

The coolant need not be wasted, but can be caught under the work in a trough and drained into a can, which can be emptied back into the coolant reservoir. This idea will save a lot of work in place of the oilcan method for cooling cutting work on small machines.

An added use for the stand with its magnetic base is as a support for a dial indicator where standard indicator stands cannot be easily mounted. The magnet holds well to rough surfaces, even if they are oily.—*Donald P. Campbell, Cincinnati, O.*

Yellow Light Reduces Glare

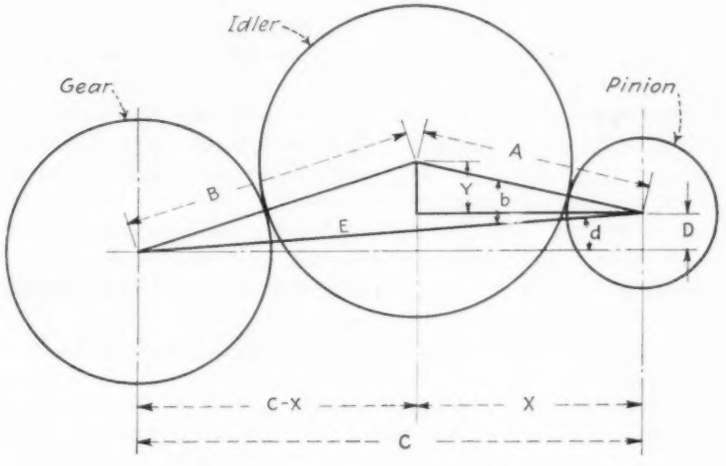
Eye strain caused when following close work in a machine can be reduced by the use of yellow-coated bulbs in the machine light. Although the actual effect of a yellow light in place of a white one is simply to reduce the amount of light, this also reduces glare. The generally-accepted theory that reading black lines against a background of yellow is easiest on the eyes also supports this practice. *Frank E. McLane, Compton, Cal.*

Drill Tables Form Mobile Bench

A mobile turntable for equipment tear-down, assembly and testing was made from two 20-in. dia. drillpress tables mounted back-to-back on a center base.

The cast ribs of the inverted lower table provided a handy sectional pan for small parts and fasteners. A collar welded to the top table fits over the stub extension of the lower table and rests on a ball thrust bearing.

The bottom table is welded to a heavy angle-plate frame that rests on swivel castors. Two "ears" on the frame accommodate a steel-rod puller for moving the unit around the shop.—*Koontz-Wagner Electric Co., South Bend, Ind.*



Idler-Gear Location—Discussion

Although the algebraic location of an idler gear given by H. L. Ahner in a recent issue is correct, it is long and difficult to derive and may easily be lost or forgotten. A simpler, shorter solution may be found through trigonometry, using the law of cosines.

With sides A, B, C and D known, sides X and Y are to be calculated to locate an idler gear in relation to a pinion. First angle d is found.

$$\text{Tangent } d = \frac{D}{C}$$

$$\text{Side } E = \frac{D}{\text{Sine } d}$$

$$\text{Cosine } b = \frac{A^2 + E^2 - B^2}{2AE}$$

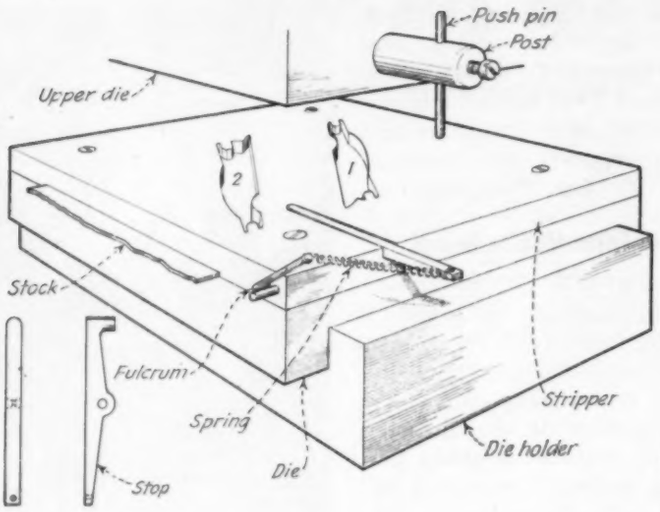
(The law of cosines)

Angle y (opposite side Y) = angle b — angle d. This is true because the line E crosses two parallel lines, making both angles of intersection equal. Finally:

$Y = A \text{ sine } y$

$X = A \text{ cosine } y$

This method applies equally well to all cases the algebraic solution covers, and will also apply to cases where the pinion is lower than the gear.—*C. Dunlap, New York, N. Y.*



Oscillating Stop Positions Stock for Punch-Press Blanking Operation

Millions of stator plates for variable radio condensers were blanked out of strip stock with the help of an unusual stock stop in the die shown. A rocking arm caught in a previously-punched hole (number 1) as the stock advanced to the left, aligning it for the next press stroke.

Action of the rocker arm depended upon a hole through its center. This hole was tapered at both ends, allowing the rocker to roll slightly. Since the slot in the stripper plate in which the rocker worked was slightly oversize, the rocker could move sideways also. The rocker pivoted on a long fulcrum rod in a hole in the stripper plate.

The outer end of the fulcrum rod was held up by a small rod projecting out of the stripper. In this position, the rod held the rocker down in its slot and against the right side of the slot through tension of a spring. However, when stock was fed against the stop, it was forced to the left side of the slot.

As the top die came down and punched a blank, the push pin held in a post in the top die forced the outer end of the rocker down. This raised the stop above the stock inside the stripper, and when the die raised again the spring pull forced the rocker pin to the right. In this position, the pin fell on top of the stock and did not fall back into rest position until the automatic stock feed moved another hole under it. When the pin fell into a new hole, the stock carried it back against the left side of the slot to position the stock for a new stroke.

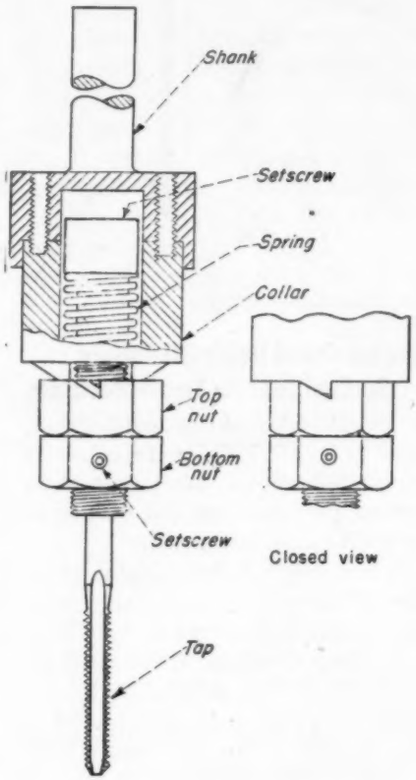
After a new strip had been inserted and the first stroke was completed, the number 2 plate was punched out in unison with the number 1, but this did not affect the stop action. *Gustave Remacle, Union, N. J.*

Mechanism Taps Blind Holes

The ability to tap a number of holes of the same diameter but to different depths is built into this tapholder. The spring-loaded clutch also disengages the rotary power if the tap becomes overloaded or hits interference in the hole.

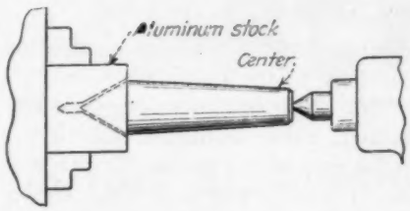
A 5/16-in. fillister-head screw was drilled out at one end to take the shanks of a limited number of different taps. These are held in the screw shank by a clamp, or, as on the original model, only one tap can be permanently soldered into position.

A coiled compression spring rides under the head of the setscrew and against a bottom ledge in the hole through the collar. This forces the upper nut, lower nut (which simply locks against the upper nut) and the tap up against the collar. Two small bolts hold the collar to the shank assembly of the mechanism.



When the tap is adjusted correctly for the load for a particular job, it is rotated through the shank and the slanted edges of the projection on the collar and the upper nut. If the tap hits bottom or a hard spot in the metal, this beveled contact slides out, forcing the shank up about 1/16 in., and allowing the shank to "free wheel." When the tapping shank is reversed, the straight vertical edges of the projection and nut contact positively and pull the tap out of the hole. Hand pressure on the drill arm must be light and sensitive.

Blind holes can be safely tapped with the device, because the clutch disengages when bottom is hit. The mechanism can be installed in a tapping head on a drillpress. *Edward Haggert, Richmond Hill, N.Y.*

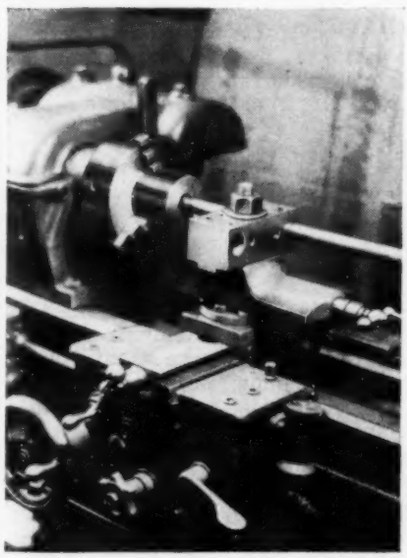


Aluminum Stock Drives Center

The high coefficient of friction between steel and aluminum is applied to driving a lathe center for regrinding in the illustration. A toolpost grinding attachment resurfaced the shank of the center.

Scrap aluminum was center drilled and bored out to a 60° tapered hole while held in a lathe chuck. The old center was then centered between the tailstock and the chuck. A 0.003-in. deep pass along the surface caused no slip, and after grinding the shank was accurate to within 0.0003 in.

Although friction with brass is not as high, it will work if aluminum is not handy. The hole in the stock should be finished, even if a large centerdrill is employed, to obtain a true taper. *Heinze M. Landauer, Tampa, Fla.*

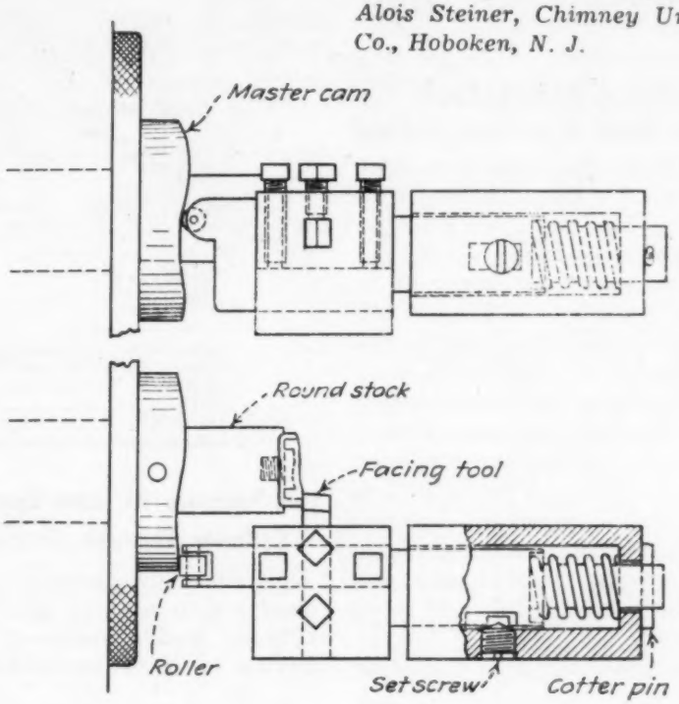


Boring-Bar Holder on Compound Handles Drilling and Threading

Small-shop drilling facilities are often limited to a single ½-in. drill chuck. One operator designed and built a boring-bar holder that would not only handle all sizes of boring jobs but would also allow drilling on a lathe with large-size drills.

The holder was shaped from a solid block of steel. Its bottom surface was cut to fit into the slot on the compound rest where a toolpost normally was mounted. A large bolt through the block held it down.

With a hole bored in the block to hold a hand die holder the use of the fixture was increased. One important advantage of the holder is that power feed through the carriage can be employed on drilling, boring and threading jobs. The dangerous practice of setting up a drill with the tailstock and a lathe dog is made unnecessary. *Alois Steiner, Chimney Umbrella Co., Hoboken, N. J.*



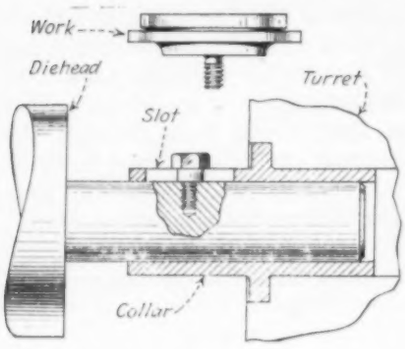
Turret-Lathe Attachment Produces Cams with Roller and Tool Holder

A simple, spring-loaded cam follower and cutting-tool holder was added to our turret lathe to reproduce cams from a master fastened to the lathe headstock. The face-type cams were cut on the edges of pressed-out blanks that had D-shaped holes punched in their faces to provide a means of driving them.

The cams were held by a bolt to a piece of round stock chucked in a collet by a flat-head screw. The stock was recessed to fit around the outside of the cam, and a D-shaped extension was left to key into the opening in the cam. The master cam was a piece of pipe that was keyed to the round stock with a single setscrew that holds it flat against the collet.

The spring - loaded follower mechanism consisted of a hollow shank that fitted into a turret position and the holder. The holder extended through the shank, and was held in place by a pin through its end. The spring rode inside the shank and around the long part of the holder. A large setscrew in the side of the shank confined the holder by fitting into a slot in its side. This prevented rotational movement.

The end of the holder was drilled and slotted to hold a facing tool at right angles to the lathe centerline and a roller that butted against the master cam. Both tool and roller support were held by square-head setscrews. *W. Lewis, Stockwell, London, England.*



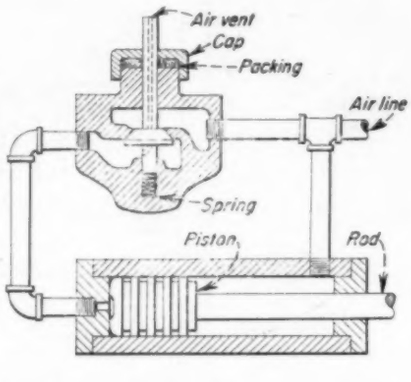
Turret Hookup Reduces Load On Small Threading Diehead

Threading a fine screw of small diameter on a turret lathe can be difficult when the work must be done in a large-capacity machine. If the turret is too heavy to be dragged along by the diehead, the work may strip. This condition can be remedied by using hand pressure to assist in moving the turret.

The diehead is made into a floating type by drilling and tapping a hole in its shank. A collar fits into the hole in the turret, and is slotted to receive a bolt. Thus the tool is free to move longitudinally, but not rotationally, within the limits of the slot.

When the machine is threading, the operator maintains enough hand pressure on the turret to keep the bolt from touching the ends of the slot. The diehead thus moves forward, after its engagement with the work, with only a slight drag.

The attachment has been useful for threading small screws which were an integral part of a large workpiece. It is equally useful for tapping operations. *Richard E. Mills, Whitewell, Isle of Wight.*



Low-Pressure Air Line Operates Cylinder Through Simple Valve

Air from a low-pressure line was employed to power a quick-acting cylinder that operated a holding device in a hydraulic press. A simple 2-way valve, its stem drilled to provide a vent, controlled air flow to the cylinder.

The normally-closed, spring-return valve admitted air to the head end of the piston for the forward stroke. For the return stroke the stem was released, exposing the vent which bled the head end and returning the piston to rest or closed position.

Action of the valve depended upon the difference in area of the head and rod ends of the piston. The 1-in. bore gave a head-end area of 0.785 sq. in., and the 11/16-in. rod reduced the rod-end area to only 0.372 sq. in. With a line pressure of 60 psi. this gave a forward-stroke force of about 24 lbs. and a return-stroke force of slightly less. The vent was large enough to provide only a low resistance to the exhaust flow.

Since the cylinder was used only for light holding work, it was an advantage to have only one simple valve and simple construction of the cylinder. The action was fast enough (push-pull cycle of about 1 sec.) so it did not interfere with the regular press-action timing. *Glen Shopbell, Dayton, Ohio.*

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Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. The decision of the readers will be final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

Who May Enter—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

How to Enter—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St., New York 18, N. Y.

57th Selection—Allen B. Nixon's Quick-Return Vise

NEWS OF METALWORKING

Military Renegotiation Formula Drawn Up for Control of Profits

WASHINGTON — While President Truman was suggesting to Congress last week that it bring back an excess profits tax, the military was putting the finishing touches to an excess-profits scheme of its own.

The military's procurement price control is renegotiation, authority for which was written into its hard goods procurement appropriations bills during the closing hours of the last session of Congress.

Renegotiation authority given the military was broad and loosely worded and it was left up to Defense Secretary Forrestal to call the turn on who would be involved. Basically, Forrestal's procurement specialists are writing a set of specifications to fit the aircraft industry and its suppliers of basic components and production tools. These new regulations are due out in the near future.

Concerns Affected

Here, in brief, are the proposed rules. You are subject to renegotiation if:

1. You have contracts or a subcontract each for more than $1,000, which will aggregate in your fiscal year a total of more than $100,000.
2. Your contract was agreed to after May 21, 1948.
3. You have an order to supply the military a plane, a basic component of it, or will supply a plane or component maker any article required for the production of an end product.
4. You will furnish or install machinery used in the processing of other machinery to be used in the processing of an end product or article contained herein.
5. You sell, furnish, or install component parts of or sub-assemblies for machinery included in (3) and (4) above.
6. You perform services directly required for the performance of contracts or subcontracts covered above.

Those Exempt

You are not renegotiable if:

1. Your contract was agreed to prior to May 21, 1948.
2. You supply certain raw materials, including products of a mine, oil or gas well, or other mineral or natural deposits, or timber, which has not been processed, refined, or treated beyond the first form or state suitable for industrial use, and all agricultural products, animals and their products, in their natural or basically usable state.
3. You are a tax-exempt, charitable, religious, or educational institution.
4. You have a contract for building construction let under competitive bidding (exclusive, however, of any machinery or equipment which has or may have a productive function in connection with processing).
5. You have a sub-contract under a prime contract or another subcontract which is exempted.

Navy Not Interested

The supplemental national defense appropriation act of 1948, which allocated $1,687,000,000 for Air Force plane procurement, made renegotiation applicable to "contracts for ships, aircraft, aircraft parts and the construction of facilities or installations outside continental United States, and sub-contracts thereunder," which would be paid for with funds appropriated for fiscal 1949 or from the balance of the $400-million appropriated under the Navy deficiency appropriation act of 1947.

The "ships" part of the wording in the law will not apply to renegotiation, in all probability, because the Navy thinks the Vinson-Trammel Act more directly suited to price control of ship building. This act sets a 10 to 12½% ceiling on profit reflected in the selling price of a ship.

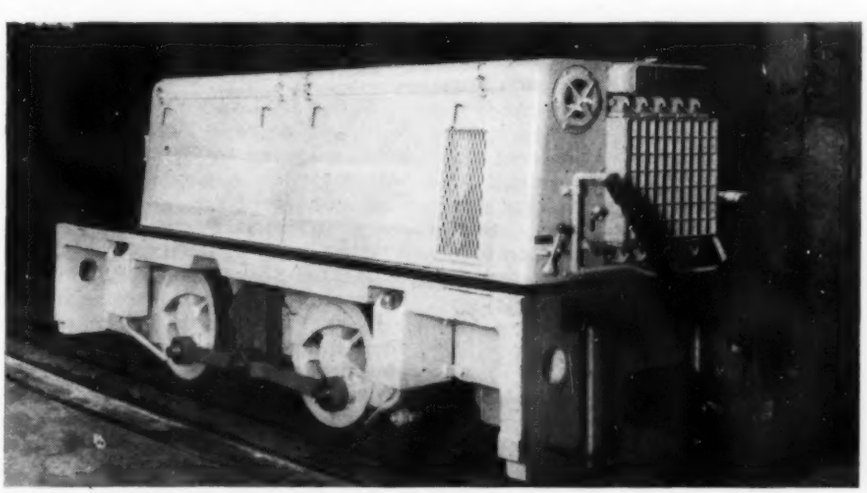
Renegotiation was also written into the second deficiency appropriation act of 1948, which gave the Air Force and the Navy another $1-billion for plane procurement. Under the two bills, renegotiation was tied to about $5-billion worth of hard goods.

Ruling Hits Machinery Firms

Hardest hit by the ruling next to aircraft companies, will be the machinery and tool manufacturers. In spelling out how machinery and allied product manufacturers come under the proposed regulations, procurement experts explain that a contract for a machine or material is renegotiable if that item is used to:

1. Produce or otherwise operate, directly, or an end product or an article included in an end product, by chemical, physical or mechanical methods—such as shaping, cutting, constructing, combining, refining, assembling, testing, inspecting, or in the case of the end product, packaging. This includes not only such machinery as rolling mills and machine tools, but also gages and other measuring instruments, torches and chemicals or other materials consumed in the course of the burning process.
2. To transport within the con-

(Continued on Page 132)



***FLAMEPROOF** diesel locomotives for service underground in British mines are built in 65, 70 and 100 hp. types. One hundred and fifty have been ordered from the Hunslet Engine Co. Ltd., Leeds, Yorkshire, by the National Coal Board as part of modernization program*

—Renegotiation—

(*Continued from Page* 131)

tractor's plant an end product or article incorporated in it, or other articles used in connection with production, such as tote boxes, tractors, trucks, and traveling cranes.

3. In connection with the repair, maintenance, equipping, or operation of the contractor's plant of machinery or equipment there used in production, including spare parts, auxiliary tools, abrasives, wrenches, screwdrivers, hand tools, or equipment located in the toolroom of a contractor's plant, and special equipment used for the manufacture, preparation or maintenance of tools, dies, jigs, fixtures, equipment or machinery.

Other Articles Cleared

In its policy declaration on renegotiation, the military points out that it is intended to exclude from renegotiation the sale of articles which contribute only indirectly to the actual manufacturing process. These items would include products used for general plant maintenance, fuel, power equipment, general office equipment and supplies, safety equipment and clothing.

Kearney & Trecker Corp. Buys Walker Turner Co.

MILWAUKEE, WISC.—Kearney & Trecker Corp., builders of machine tools for milling and boring, has purchased the Walker-Turner Co., Inc., Plainfield, N. J., manufacturers of light machine tools for industrial and home workshop uses, Francis J. Trecker, president announced recently.

The Walker-Turner plant, which will continue its operations as the Walker-Turner division, Kearney & Trecker, occupies 180,000 sq. ft. and employs about 400 persons. All facilities will remain in Plainfield and general supervision will continue under the present management.

Established in 1922, the company has emphasized since 1937 light machine tools for wood and metal for industrial applications, whereas originally home equipment was specialized in. The products of the company are distributed by 500 dealers throughout the United States, Canada and foreign countries.

India Turns Down Tariff To Protect Tool Industry

NEW DELHI, India—(McGraw-Hill World News)—The government has rejected a proposal by the Tariff Board to set up a protective tariff on the infant machine tool industry, claiming a duty did not appear practical and would not aid the development of the industry.

***SHEARING OPERATION** is watched by a group of visitors at the enlarged Cleveland, Ohio, steel-service plant of Joseph T. Ryerson & Son, Inc. Customers and friends attended an open-house celebration*

A. G. Bryant Leaves for Europe To Confer with Officials of ECA

NEW YORK—A. G. Bryant, president National Machine Tool Builders' Association and vice president Cleereman Machine Tool Co., left on August 6 on the QUEEN MARY for conferences in Paris with officials of the Economic Recovery Administration and in Paris, London and elsewhere with machine tool importers' groups. He also will attend the British Machine Tool Show at Olympia in London.

One of Mr. Bryant's chief aims will be to spur foreign governments and the industry's foreign representatives to faster action in recommending programs for industrial recovery in western Europe. Large quantities of U.S. machine tools are desired by private industry abroad. The intent is to get such business freed to U.S. builders. For the Paris conferences Mr. Bryant will be joined by Tell Berna, NMTBA general manager, and M. A. Hollengreen, president Landis Tool Co. and chairman NMTBA's government relations committee.

Export shipments of machine tools before the war averaged 20% of total production. Lately they have fallen to 10-15%. The machine tool industry expects, however, that the coming fall and winter substantial orders will be placed by private industry in Europe, after ECA has had a chance to screen properly the projects involved and establish the necessary credit.

Materials-Handling Program Opens

"Materials Handling in Receiving, Warehousing, and Shipping" is the latest addition to General Electric's "More Power to America" program. The new program is designed to show industrial companies, warehousing and distribution organizations, and other groups interested in increasing production, how to reduce costs through the use of more efficient materials handling equipment and methods.

A 16mm., all-color sound motion picture and a 96-page application manual have been prepared under the technical supervision of GE materials handling authorities and in co-operation with manufacturers of materials-handling equipment and their associations. Arrangements for this program are now being made throughout the country by manufacturers of materials-handling equipment, electric utilities, and GE district offices.

The film, emphasizing materials handling as one of industry's largest costs, illustrates all types of equipment and demonstrates its efficient operation.

The illustrated manual features sections explaining how to make a handling survey and presenting engineering data on the selection and use of equipment for the most efficient, low-cost handling system.

This program, thirteenth in the "More Power to America" series, typifies exactly the MPA philosophy of increased benefits through increased electrification and modernization, according to Mr. F. W. McChesney of G.E.'s main MPA committee.

Business Awaits FTC Action on Price Decision

WASHINGTON—Many management men who never before have been particularly interested in following actions of the Federal Trade Commission now are watching it with an eagle eye. The reason is that they're looking for some kind of tipoff as to how hard FTC will swing the Cement Institute decision against delivered pricing in other industries.

One such tipoff came to light recently in an FTC case against National Lead Co., and a half a dozen other producers of white lead and other pigments for paint manufacture.

In its brief on a trial examiner's recommended decision, FTC trial lawyers reiterated the idea that delivered pricing is illegal only if the commodity is:

1) standardized with little quality difference between the product of one seller and another and

2) so heavy that freight charges are an important part of the final cost of the product to the buyer.

Another point in the case involved the trial examiner's finding that, in this industry, there was no price discrimination against near-the-mill buyers when a producer charged one delivered price to all customers within a single zone.

Speaking of the scope of the Cement Institute Decision, here's what the FTC lawyers wrote:

"Arguments will no doubt be advanced that (the Cement Institute Decision) would necessarily result in condemning any universal delivered price system in any other industry, and would be . . . applicable not only to the heavy industrial products here but to chewing gum, candy, magazines, and a host of other common articles of commerce which are sold on a universal price. Such argument is without foundation."

In the lead pigment industry, said the FTC brief, systematic freight absorption and phantom freight involved in the zone delivered pricing system resulted in (1) no competition between the producers and (2) price discrimination against near-the-mill buyers.

However, says the brief, "obviously there cannot be any serious injury to competition among either buyers or sellers if transportation charges bear no substantial relation to the price of the article sold."

The National Lead case is important, too, for this reason:

In it, a trial examiner ruled that use of a delivered price doesn't result, in this industry, in discrimination against the buyers in a single zone. He found that the delivered price within the zone permitted buyers of pigments to compete with one another on an equal basis. But he also ruled that different prices for different zones produced price discrimination.

The Commission's attorneys thought they saw in this kind of logic a chance for the defendants to use a universal delivered price—or one-zone system. In other words, if prices within a zone aren't discriminatory as long as there's one delivered price to all customers, then why not enlarge the boundaries of that zone to include the whole country?

So the lawyers wrote: ". . . the commission should enter an order . . . which would prevent any such pricing as a common system in this industry." (Ed note: words "in this industry" underscored by FTC.)

However, the lawyers agreed that banning the universal delivered price system "would be entirely inapplicable to any industry or product where transportation charges would not effect competition in a substantial manner."

It'll be sometime yet, however, before the Commissioners themselves get a chance to put themselves on the record by upholding the trial examiner or their own lawyers.

***JET PILOTS** will receive training instructions in this new T-28 plane being built by North American Aviation for handling ultra high-speed jet aircraft.*

Warner & Swasey Appoints Curtis Engineering Head

CLEVELAND—Myron S. Curtis, assistant director of engineering, has been named director of engineering of the Warner & Swasey Co., succeeding William J. Burger. Mr. Burger retired June 30.

The board of directors also named Mr. Curtis and Frank E. Joseph directors. Mr. Curtis, one of the members of the planning committee named in 1943 to guide the company's investigation and development of new products, has been largely responsible for the development of the Warner & Swasey weaving machine.

Accurate Social Security Returns Sought by U. S.

WASHINGTON — Accurate returns from business and industry of quarterly social security reports are vital not only to prevent improper payment of benefits but to insure correct statistics for use by industry and business in market research and other planning.

The Bureau of Old Age and Survivors Insurance, Part of the Social Security Administration, stresses:

When federal social security returns are prepared (Form SS-a), give particular attention to the item which asks for the number of persons employed during the pay period which ended nearest to the 15th of the 3rd month in the quarter. The figure should include all employees on the pay roll during that period whose services are covered by the Social Security Act. However, the figure should exclude persons who received no compensation during that pay period (as, for example, persons who received compensation prior or subsequent to the pay period, but not in this pay period); pensioners; and others not on the active list. The number of active employees during a single pay period of the first quarter of each year is quite likely to be smaller than the total number of employees listed on quarterly returns, because of labor turnover and seasonal employment. For the second, third, or fourth quarter of the year, the number of employees during a single pay period may possibly equal or exceed the number of employees whose names are listed on the return, when the $3,000 limit on taxable wages obviates the need for listing employees for whom the employer has previously reported taxable wages of as much as $3,000.

Detroit

BUYER'S MARKET MAY BRING BACK FLEXIBLE TOOLING IN AUTO PLANTS...TOOL AND DIE STRIKE CONCLUDED

A new course of thinking is beginning to infiltrate into the minds of the production planners of the automobile industry, one which bears importantly on the outlook for the machine tool builders.

The thesis stems from the fundamental change in the condition and size of the automobile market which is due for arrival sometime in the future—perhaps a year hence, perhaps longer. When that shift arrives, the auto industry will be faced with a buyer's rather than a seller's market. That means a return to the year-by-year model changes of prewar days.

Disadvantages Visible

This thinking involves the prospects of tooling sources in this respect: Up to now there have been three years of generally negligible change in models, taking the industry as a whole. The result has been that the auto plants could tool fairly inflexibly. The influx of transfer machines is one manifestation of this comparatively inflexible and expensive tooling.

But, with yearly model changes ahead, disadvantages may become visible in the complex, high-priced machines. After all, their amortization goes on day in and day out, involving substantial amounts, whether they run full speed, half speed, or not at all. Consequently, any return to less sustained activity levels may bring with it the desirability of simpler, cheaper, more easily and more inexpensively retooled equipment.

In other words, during a slack period it may be more economical to adjust to realities by revisions of manpower than by shutting off expensive equipment. And in times of more frequent changeovers, it may prove more economical to retool standard machines than rebuild specials.

Tooling Programs Moving

This thinking, of course, runs counter to the usual viewpoint that as wage costs go up, manufacturers must be driven to more machinery and more intensive tooling to balance out costs. But the two trains of thought are not incompatible. They can be reconciled by some sort of dividing line. It can be said that at scattered points through the auto industry, production executives are contemplating this problem and trying to decide where to draw the line.

***ASSEMBLY MACHINE** for tire and wheels in Studebaker's new truck plant has reduced the amount of work usually required in this operation. Workman at right is operating hydraulic press, the vertical movement of which locks the rim and wheel. Tires and wheels move on a conveyor*

The cleanup of the United Auto Workers Union strike in the 77 member shops of the Automotive Tool & Die Mfrs. Assn. brought about some renewed activity in tooling programs for 1949 passenger car companies.

Chrysler's program, which has begun to approach finalized form, is reported to be at the stage of placing tooling orders with the shops as well as the machine tool companies. Fall delivery dates indicate that the new models will be appearing around the end of the year.

Kaiser-Frazer Corp. has new models on the threshhold of introduction: they apparently will come along later in the summer or early in the fall. The K-F line will still not encompass a full range of body styles. Full lines are in the cards for the 1950 models, indicating a substantial amount of tooling ahead from the Willow Run producer.

15-cents-an-hour Raise

The settlement in the Detroit tool shops was for a blanket 15¢ per hour raise. This advances the average rate to somewhere around $2.22 for all production employes, skilled as well as unskilled people.

Although the raise was in excess of the 13¢ pattern followed by most automotive companies, it was not considered out of line, inasmuch as the craftsmen involved constitute the highest paid group in the Detroit area. In past years U.A.W. pressure has been for larger raises in higher paid classifications, so as to maintain customary differentials.

On this subject, it might be noted that the recent auto union wage settlement with Ford provided for future negotiations on merit raises for tool, die, maintenance, and construction men. Previously these trades worked within specified wage spreads, and raises were almost solely in the hands of company supervisors, etc. U.A.W. has been pressing in the past for a system of regularized advances through the spreads at specified intervals. The agreement of the company to negotiate this issue indicates that some consideration may be given to the union position.

Feeder Strikes Bothersome

Although wage agreements have been reached in virtually all the largest Michigan companies, there is still a notable strike undertow following the settlement tide, pulling down feeder plants. The picture is not yet stabilized.

One of the best illustrations of this instability is in the recent report of the Michigan Unemployment Compensation Commission, showing that labor turnover in April rose to 6.5%, from 5.7% in March. Voluntary quits went up from 3.5% to 4.0%.

Machine Tool Industry Holds Sales Course

TO IMPROVE the technique of machine tool salesmen and to provide them with knowledge which will enable them to be of greater service to customers, the machine tool industry conducted a sales refresher course for a limited number of its members at Cornell University, Ithaca, N. Y., July 12-23.

This course, sponsored jointly by the National Machine Tool Builders' Association and American Machine Tool Distributors' Association, was unique. It was an industry-wide operation in the full sense. Students consisted of company presidents, sales managers, salesmen. Top officials and salesmen alike went back to college for two weeks. The "faculty" was recruited from the top ranks of machine tool builder and distributor companies, from machine tool users and from the teaching staff of Cornell.

Dan Weedon, Blanchard Machine Co., "Director" of the course, with the "Faculty" and visiting "Professors" who addressed the July 14th session. Left to right: Mr. Weedon, Tell Berna, general manager, NMTBA; (below) James Weaver, Westinghouse Electric Corp.; (above) Everett Morgan, vice president, Giddings & Lewis Machine Tool Co.; Prof. Harry Loberg, Cornell University; Harold Warner, Cadillac Division, General Motors Corp.; James Hebert, general sales manager, Jones & Lamson Machine Co.

Four Fundamentals Covered

Four fundamentals in the sale of machine tools were covered by the course: (1) the origination of an inquiry, (2) the selection of the proper equipment to be quoted, (3) the presentation, and (4) the economic analysis of the purchase of machine tools.

The program was under the guidance of the NMTBA's sales and service committee headed by Daniel R. Weedon, assistant manager, Blanchard Machine Co., and the AMTDA's sales and service committee of which Robert L. Giebel, president of Giebel, Inc., is chairman. These committees, with the assistance of A. G. Bryant, association president, and Tell Berna, general manager, prepared the entire course. This group had the cooperation of Dean S. C. Hollister, Sibley Engineering College, Prof. Harry J. Loberg and other Cornell faculty members.

On this page and the next 11 pages, the editors of AMERICAN MACHINIST present the main points brought out by the "instructors" in their lectures. Space unfortunately prevents setting forth the remarks of all speakers. This report therefore is confined to presentation of facts directly pertinent to the sales job. It omits discussion of the social and economic implications of machine tools and of the place of machine tools in our society.

Fifty-three took the course, with 32 from machine tool building companies and 31 from distributors.

The Four Fundamentals — Scope of the Course

By JAMES C. HEBERT, sales manager Jones & Lamson Machine Co.

THE creation of an inquiry is where we start to sell. If a field engineer does not have the ability to create inquiries, he has a slim chance of getting an order. You can measure the ability of a field engineer by the number of inquiries originated and percentage of inquiries turned into orders.

Machine tool purchases which originate from inquiries direct from the customer are in most cases bought and not sold. Inquiries received through field engineers are the result of the work of these men in creating a desire to buy. This may be from a desire to reduce manufacturing costs, increase production or replace an old machine.

Whenever you are to make a call, review every piece of equipment you have to offer this particular customer and prepare to give him some information of value.

We must analyze what every customer wants and needs if we expect to design and build equipment that we can sell. Vision and imagination are two of the most important qualifications of a sales engineer. You cannot expect your engineering department to do your thinking for you. Unless a sales engineer knows what is inside his customers' shops he can only talk in generalities, and generalities never sold machine tools.

In the sale of high production and special machinery, the sales engineer must visualize new applications and originate thoughts which can be discussed with the customer and later with his own company. He cannot take a drawing of a part and send it to his company and say "here it is." He must obtain from the customer the sequence of operations, proper location points, degree of accuracy and finish required, and a fund of technical information, including anticipated production rate.

We have not gone as far as we should in adapting and selling high production machinery to production of several parts where the quantity of each is not sufficient to justify purchase of a line of machine tools for manufacturing the individual item.

The sales engineer can materially improve his service to his customer if he has an understanding of the

application and use of the most common equipment which complements his products in a production line. To the sales engineer: properly prepare yourself with complete information on the proposal you are presenting before you visit the customer. Don't hesitate to ask for someone from your engineering department or your home office if you are not familiar with all the details. This interview alone may prove success or failure. It may be your only opportunity to do a selling job.

Don't hesitate to take time enough with the customer to explain in detail what you are offering. If he can't give you sufficient time, don't leave the proposal. Take it away and ask for an appointment later. If you are quoting on a standard machine with a standard group of equipment, discuss every exclusive feature and translate those features into terms of productivity. Discuss every attachment and justify quoting on them.

Presentation of a quotation covering a production machine, where tooling layouts and production estimates have been made, is another type of approach. Determine with the customer that operations you propose will fit into the sequence of operations for the particular piece. Cutting speed, rigidity of tool mounting, rigidity of work-holding units are all a part of a successful high-production machine tool. All of these points should be discussed in detail.

If your machine is to be tooled with carbide cutting tools, discuss the speeds and feeds to be used and the horsepower required to do the job. Only a small percentage of machine tool purchasers know horsepower requirements.

A Typical Situation Employing General-Purpose Machine Tools

By E. K. MORGAN, vice president in charge of sales, Giddings & Lewis Machine Tool Co.

I HAVE presented a typical situation with all factors known, augmented by charts and graphs. From this situation I have endeavored to outline a procedure which will enable the sales engineer to analyze an unsolved machining problem. I do not advocate that he make parallel solutions.

Primary steps in determining correct production methods:

1. The sales engineer must have, or create, an opportunity to express his basic ideas.
   a. This anticipates familiarity with a broad range of machining operations.
   b. This knowledge may be adapted directly to, or modified for, the particular problem at hand.
   c. Such suggestions or ideas presented to the product manufacturer will create both interest and confidence.
2. The consulting sales engineer must obtain a statement from the manufacturer outlining the problem and the solution.
   a. There must be mutual understanding on this point.
   b. If the job is already set up, the manufacturer should show the consulting sales engineer the steps followed.
   c. The consulting sales engineer should make it a point to go over the customer's plant to orient himself with physical conditions that bear upon the problem.
3. The manufacturer should unhesitatingly furnish complete prints of the product to be produced.
   a. Prints should be marked and complete notations made in the presence of the manufacturer's men interested in the job.
   b. Only general comments about a possible solution should be made by the consulting sales engineer.
      1. This is precautionary for later study and comparative analysis may change the original machining concepts completely.
4. It is important not to hurry in obtaining information.
   a. Touch upon any point which may have a bearing upon the machining problem.
      1. Do not hesitate to ask direct and even leading questions if such answers will ultimately serve in solving the problem.
   b. Do not depend upon memory —write it down.
   c. Use a definite sales engineering data form.
      1. Such forms are not only helpful to you but also to your associates.
      2. Be sure the information on this form is correct.
      3. Get plant photographs if possible; they may be helpful in planning.
5. Present all information including your ideas as completely as possible.
   a. Assimilate all data carefully and logically—it will help the people who work with you.
   b. It will help you in clarifying any points in your own mind that you do not understand.
   c. It will make you ask for more facts if you find some have been omitted.
6. Don't take too much for granted and assume there is but a single way to solve the problem.
   a. The consulting sales engineer must have a flexibility of mind and thought which will permit him to see objectively rather than subjectively.
   b. Don't be too quick to change an idea that is good and which you know is good just to meet the whims of an individual buyer.
7. Keep constantly in mind you are a consultant who through ability, knowledge and training are able to help solve difficult production problems.

How the Machine Tool Salesman Looks to the Buyer

By W. A. SREDENSCHEK, assistant to the vice president, Traffic and Purchasing Depts., General Electric Co.

THE machine tool salesman today is the key to a large number of problems that have fallen on the buyer's shoulders during the past decade. A salesman should make it a point to call on his customers regularly and offer any help he can give.

Many salesmen lose interest in a job as soon as they receive the order. The salesman who makes the best impression stays with the job until it is installed and operating.

Some purchasing agents feel that the average salesman calls too often on the man he likes and not often enough on the man or company he does not like. From a buyer's standpoint, it is just as objectionable to have a salesman call too often as not often enough.

Harry Erlicher, vice president in charge of purchasing in our company, made these comments about salesmen:

"1. The average salesman talks too much about irrelevant things.

"2. He should spend his traveling time preparing his subject matter so that when he does get to see the buyer he can present his story precisely, efficiently and completely.

"3. If the salesman is accompanied by more than one associate, the buyer feels that he is being 'ganged.'

"4. If the salesman doesn't know an answer, he should tell the customer and then quickly get the answer.

"5. Salesmen should not gossip. They get much confidential information about new manufacturing processes and should not pass it on to the customer's competitors.

The new generation—ambitious to serve machine tool users even better than their dads: (left to right) Joseph F. Owens, Jr., J. F. Owens Machinery Co.; Donald M. Patterson, Avey Drilling Machine Co.; (above) W. Hawley Scott, Jr., Syracuse Supply Co.; Charles W. Knight, W. B. Knight Machinery Co.; Carl Linden, Jr., Cinrock Machinery Co.; Frank H. Habicht, Marshall & Huschart Machinery Co.; John C. Hussey, Jr., American Tool Works Co.

What Information Should the Sales Engineer Give the Customer?

By HAROLD G. WARNER, assistant master mechanic, Cadillac Motor Car Div., General Motors Corp.

WHEN a manufacturer requests a quotation on a piece of equipment, he expects the sales engineer to present a complete outline of his equipment, with detailed explanations of all recent improvements and changes. Then it is necessary to determine what equipment is best suited to the job. The customer usually has some opinions and desires, even prejudices, which must be discussed so that a common understanding is reached.

All features requested by the customer should be described in detail in the quotation. Features considered impossible or impractical should also be explained.

It is possible to design a completely automatic machine with automatic loading, processing and unloading, on the one hand, or to use the simplest, most elementary standard machine tools. Somewhere between these two extremes lies the correct selection. Rate of production, length of time the part is to be produced in, and the anticipated maintenance required for the various types of equipment msut be taken into consideration by the builder.

The factors which determine the machine to be selected for a given job will vary in the order of importance with different jobs.

1. Reputation of the builder.

The builders' previous performance with regard to quality, availability of service and follow-through: the sales engineer who has made it a point to follow through on a customer's equipment finds himself in possession of a valuable asset of good will.

Builder's specialties: Where a given type of construction is indicated, it is logical to favor the builder with experience.

Builder's capability and financial stability: The customer finds it necessary in a large tooling program to assure himself that the builder has plant capacity, that he be able to make the necessary outlay for material, labor and overhead without financial embarrassment or inconvenience. Selection of builder requested to quote: here is a place for the sales engineer to show an intimate knowledge of his firm's facilities to answer correctly the abovementioned points.

2. Presentation of information to the sales engineer.

The interest shown by the sales engineer is an indication to the customer of his firm's atttude and interest in producing the piece of equipment under consideration. Ability and willingness to accede to the customer's wishes with regard to design: here the sales engineer is confronted with the job of selling his firm's ability and willingness to produce the equipment according to the customer's specifications. If the customer's request is on the impractical side, the sales engineer's technical and diplomatic prowess are tested.

The sales engineer's capability: the sales engineer should be up-to-date in the latest manufacturing processes. He should know his competition and be able to suggest features and devices to improve the equipment requested.

3. Quotations.

Promptness: nothing is so disconcerting to a process engineer as to have all his quotations in except one, when he has a production deadline to meet. The sales engineer is the expediter in this situation. Completeness: customers feel that very few quotations are complete. The sales engineer must familiarize himself with all requirements of the job since the completeness and accuracy of a quotation is a true measure of how good a job the sales engineer has done. Escalator clauses and contract variables: the escalator clause is an undesirable adjunct to a contract. The fact that the majority of firms have eliminated escalator clauses since the war, places the remaining firms in an adverse position.

4. Maintenance of accuracy.

Rigidity: we don't object to buying cast iron at machine prices if it eliminates vibration and makes for greater accuracy. Quality of spindles: none but the best spindle will suffice if maintenance and down time are to be reduced to a minimum in continuous production. Quality of fixtures: There is an increased trend toward tool programs where both the machine and fixture are provided by the machine tool builder not only from the quality standpoint but by placing responsibility in one place. Consistent locating and clamping are two of the most important fundamentals in fixture design. Reliability: in modern production plants reliability assumes a position of prime importance. When a machine on a production line goes down for 10 minutes, the loss is 10 minutes times the number of men on that particular line, or as the customer thinks of it, 10 automobiles, 10 washing machines or 10 refrigerators. Therefore a customer evaluates equipment on (1) freedom from trouble (2) ease of servicing (3) type of control and the advantages and disadvantages of mechanical, hydraulic or electrical.

5. Production rate.

The ability to produce the volume required is just as important to the customer as any other part of the contract. The machine tool builder's production estimate is a factor which the user of machine tools has not, up to the present time, been able to put too much faith in; and we, therefore, feel that here is a real opportunity for the sales engineer to do a job.

6. Previous service from similar equipment.

The customer naturally likes to have a satisfactory operation of similar equipment.

What Does the Buyer Want?

By W. J. PEETS, chief engineer, Singer Mfg. Co.

FIRST requirement of a new Singer product, regardless of cost, is that it must operate properly at required speed. Second, it must stand up at this speed. Third, it must be readily operable. Fourth, it must be easily serviced with completely interchangeable parts. Fifth, the production cost must be low enough that the product can be sold at a profit.

Planning the manufacturing facilities, especially machine tools, special machinery, jigs and fixtures, and tools, is done while the new design is still on the drafting board. By the time the first models are built, methods of manufacture and tooling are well roughed out. It may be a year or more before tests of the new models are completed and the decision is made to go ahead. What I wish to emphasize is that no step in product design can be taken without considering in detail how each part is to be made.

During this long period of engineering planning, the machine tool sales engineer is asked to help. What we look for more than anything else is the man who can temporarily become a member of our engineering staff, who will give us real facts as to what his machine tool can or cannot do.

The machine tool sales engineer has a double responsibility. He must represent his company in dealing with the buyer, and represent the buyer in dealing with his company. Selection of machine tools depends more on accurate information than on all other things combined.

The buyer has three main thoughts: (1) Will the machine tool do the job? Is it the most suitable machine? (2) Is the purchase a good investment? (3) Is the company selling the machine tool responsible? Will it promptly rectify any faults which develop after delivery?

We should never get the idea that our machine tools and processes are good enough. When manufacturing tolerances are put on a drawing, they do not represent the degree of perfection desired, but rather that obtainable from available machine tools.

Tooling a new product is a challenge to the engineers involved. It is not enough to machine the new part as well as you are now doing the old part or as well as your competitor is doing. You must do better.

The extent of a sales engineer's knowledge is evident after he is in the buyer's office only a few minutes. The engineers with whom he is surrounded are subjecting him to the test that he is supposed to subject them to. If their analysis of him is not satisfactory, they may select some other machine than his or may ask his company to assign a better qualified man to contact them.

A qualified sales engineer will only say "yes" or "no" when he knows the answer. If he is not afraid to admit that some things are impossible, he will build up the confidence of other engineers in him.

After the machine tool order is placed, the buyer still likes to consider the sales engineer as his representative. He expects delivery promises to be followed up. When the delivery is made, he looks to him to arrange any necessary service or to correct any oversight or error.

Selecting the Equipment to Be Offered

By E. PAYSON BLANCHARD, director of sales, The Bullard Co.

SELECTION of equipment is the key decision between the salesman and his customer. It calls forth all the engineering knowledge required in selling machine tools, but, more important, turns the spotlight on capital investment, manufacturing cost and profit. Such selling requires a knowledge and understanding beyond the technical requirements of the job. It leads into business administration and the economics of manufacture.

The engineering involved in basic design of machine tools is fundamentally important in that it must meet adequately the modern requirements in metal cutting. But refinement in design beyond the basic elements is more often aimed at economy in use. The salesman, therefore, is called upon to justify the extra investment in such refinements by cost saving in performance.

Highly-specialized machines may do the job in less time with a corresponding increase in initial investment costs, but remember that equipment is chosen not for the acme of performance, but for the accumulation of profit. It is up to the salesman to prove how closely these coincide for the benefit of the customer and under the manufacturing conditions which his proposition stipulates.

Final selection therefore is a conclusion drawn from engineering facts, from close scientific estimates based on engineering knowledge, from actual conditions in the customer's plant, from opinions and speculative factors with regard to developments, and from a final financial analysis. The customer often approaches such a problem with an understanding of the factors and the conditions, and frequently with a premeditated preference (which may or may not be well-founded). He demands to be fully informed by the salesman on all of the factors involved, frequently including an estimate which analyzes the operations and states rates of performance which are presumed to be capable of accomplishment, under the conditions imposed.

It is presumed that an honest check of the factors and rates of performance offered in the estimate will be in keeping with the customer's own intimate knowledge of the job and that the machine tool builder has presented his proposal on the basis of an honest estimate of the ability of his equipment to produce, since engineering deals with material things, facts, established principles, and theorems, and only a minor phase of the conclusion can be referred to matters of opinion. This is the basis for the statement, often quoted, that most machine tool equipment is bought, not sold.

The man with the best proposition generally wins, most often on thoroughness of presentation, rather than on his personality or sales psychology.

Personal Qualifications for Builders' Salesmen

By M. C. CLARK, assistant to sales manager, Cincinnati Milling & Grinding Machines, Inc.

THE personal qualifications of a salesman are these: (1) integrity, (2) ability to get along with people, (3) knowledge of the customer's problems, (4) knowledge of your product, (5) knowledge of your competitor's product, (6) hard work, (7) perseverence, (8) orderliness and accuracy on details, (9) enthusiasm and (10) showmanship.

All of us know many people of high character who are not salesmen. We also know men with character and plenty of knowledge, but they lack the action qualifications necessary to be salesmen. For salesmanship is, first and last, action. Combine proper character qualifications with proper knowledge qualifications, and then add action qualifications and you have a man who, with proper training and direction, will become a professional merchandiser of machine tools.

What Should the Sales Engineer Know About Any Particular Prospect?

By ROBERT L. GIEBEL, president, R. L. Giebel, Inc.

WE, AS salesmen, are in effect, both a friendly prosecutor and a defense attorney. When we step into the courtroom, our customer's office, we must have all the facts, not only about the product we want to sell, but about the company and its representatives.

One of the first things we must do is to get the customer's attention and then hold it by getting his interest. We cannot know what interests him unless we know what he makes, how he makes it, what his short and long-range plans are, and, most important, something of the personality of the company and the man who does the final selecting. Successful lawyers make thorough studies of the personalities of the judges and juries who are to try their cases, and present their facts accordingly.

As far as possible we give a new salesman a resume of all past transactions, a list of installations, names of executives and the like, but ask him to use these facts only as a preliminary guide. After he gets past the front door, he must check the facts and add to them.

We should get financial facts from the company's own financial statement, from credit references, or from credit reports. But we can't make a decision on financial statements alone. All of us have sold machines to companies with unattractive financial statements and have got paid for them.

Try to learn whether your prospect's product has merit. Does he know how to manufacture? Does he know how to sell? Does he have enough capital? Get the facts, don't guess. Learn who actually selects new machines. Titles usually mean little except in large companies. Some place, somewhere in every organization is a man who selects the equipment. He is the contact you must make. Instead of getting all the pertinent facts first and then forming an opinion, many salesmen guess and assemble only those facts which substantiate that guess. Many salesmen also make a mistake of developing the "gossip complex." Don't be curious about your prospect's private life.

Sometime while relaxing in the reception room, awaiting an important interview, give yourself the "acid test." Record all the facts you know about the prospect, his company, and its problems—then decide whether you are prepared to argue your case. If not, why not?

Sales Presentation to a Group

By FREDERICK A. BRECHTER, vice president, Vandyck Churchill Co.

WHEN several persons in a buying organization are interested in large purchases of machine tools, it might be well to ask for a group interview or a series of them.

All general foremen should be got together first, with a superintendent as mediator. If possible, have one session in the morning and another in the afternoon. Perhaps a group luncheon can be arranged. If one man or another is constantly called out of the interview, ask if you can have a closed session and without interruption.

Edward Voss, who presided on July 22, talks to a group of "Professors," George Habicht, Jr., Marshall & Huschart Machinery Co.; E. C. Adams, Van Norman Co.; T. R. Rudel, Rudel Machinery Co.; L. W. Scott Alter, American Tool Works Co.; B. N. Brockman, R. K. LeBlond Machine Co.; E. W. Voss, Voss Machinery Co.

In selling to a group, avoid arguments. Be sure to give yourself enough time to plan your program correctly and solidly. Two persons should preside at the interview: one representing the customer and the other the builder or distributor himself.

Sales representatives should have written notes on the subject discussed. In that way, smoothness and continuity of thought will make the interview interesting and pleasant. The ideal situation is for a distributor to present a sales talk to a group with a representative of his builder attending. The distributor should preside; after a brief discourse, the meeting should be turned over to the builder's representative. A prearranged interruption should be injected by the distributor to avoid monotony. Ample time should be allowed for discussion.

Should a detailed discussion on gear velocities and pressures, or perhaps load capacities of certain antifriction bearings, or their method of application, be necessary, a factory engineer should make the presentation.

Moving pictures are good when they show actual demonstrations, but are not as effective as slides. A lecture can usually go along with each slide view. Photographs of good installations are helpful but must be large and easily placed on an easel. Literature about your equipment should be given out just after the presentation and before starting the question-and-answer period. Suggestions emanating from question periods could well be forwarded to your builder for study.

When no more questions are forthcoming, ask for direct opinion. If you receive favorable reaction from a large percentage of the group, ask for the order.

Sales Procedure — The Written Word

By ARTHUR B. KETTLE, executive vice president and general manager, Austin-Hastings Co., Inc.

IN SALES correspondence remember that the written word is the spoken word in print. Avoid using stereotyped expressions and write just as you talk. In letter writing you can improve upon the spoken word because you can proofread or censor the words your customer is going to read before he has an opportunity of seeing them.

The following rules will give your letter a better chance for success:

1. Never assert anything debatable or untrue. Never give your prospect a chance to argue, to doubt you, or to say no.

2. Never check or interrupt the steady flow of your prospect's thoughts. An ambiguous statement or a statement that is not logical does this.

3. Don't use long paragraphs. Break them up into smooth, short ones which are easy to read.

4. Give all the facts about your proposition that your reader could possibly want to know. Make clear either by saying so, or by implication, every service or important function the machine will perform for your prospect.

5. Pick out the type of machine your prospect should have and tell him why he should have it. Make it as easy as possible for him to select and buy.

6. Show justification for purchase —be positive, not negative. Set forth your own convictions that this is the only logical machine for the job.

A Survey of Machine Tool Buyers

By HERBERT L. TIGGES, executive vice president Baker Brothers, Inc.

TODAY, as in days gone by, we cannot sit back and wait for inquiries. Our sales forces must be out doing creative selling. To do this, I feel that it is fitting for us to examine ourselves from the viewpoint of our customers. Accordingly I prepared a machine tool sales survey questionnaire and mailed it to a cross-section of buyers. I got back a 60% reply. Those who cooperated brought out some interesting information and constructive comments.

In no case was our selling rated under 75. That is a source of gratification. In weighing the results of the survey, remember that it is based on replies from a limited number of buyers. But the companies represented have a high standing in their industries. One cutomer made the following comment, "I feel that the day of the salesman is over. The new name sales engineer is descriptive of the man needed, with enough experience and training to put himself in the customer's place, and to realize what the requirements are."

SURVEY RESULTS

QUESTION	% YES	% NO
Do our sales representatives suggest machines which prove to be good investment over your present equipment?	69	31
Above question indicates salesman knows your product and your methods of machining. Are you willing to let salesmen have this information?	100	0
Do majority of salesmen make effective use of your cooperation, if answer to above question is "yes"?	96	4
When you issue inquiries not originated by salesman, do majority investigate to determine whether, machine you specify is best suited to your work?	58	42
When salesman calls, and you give him inquiry, is he thorough in securing information?	88	12
Do salesmen ask permission to go into shop to see work?	88	12
Do most salesmen get all the necessary information on the first call (30%), second call (54%), third call or more (16%)?	—	—
Are salesmen well informed on their proposals, to enable them to make concise explanations and answers to your questions?	88	12
Is it the usual procedure for salesmen first to hand you the proposal for your perusal?	77	—
Or do they explain the recommendation with discussion and answers, and then give you the proposal for later study?	23	—
What is your preference on delivery of proposals?		
1. Mail, to allow for study and then call by salesman?	40	—
2. Personal presentation by a salesman?	60	—

QUESTION	% YES	% NO
Do our proposals give you sufficient information?	42	58
Do you find it necessary in the majority of instances to ask for more information?	45	55
Do you prefer proposals written in letter form?	16	—
Or on proposal forms, with proper item headings, arranged in sequence of importance of information?	84	—
Do our sales representatives give you information on dollar return on your investment?	8	92
NOTE: This can be done by our industry through your cooperation. To really do a thorough job from all angles of return, our engineers need information from you, such as your present maintenance cost, if old machine is being replaced, as well as present depreciated value of old machine, cutting tool costs, present production, etc.		
Does policy of your company allow for supplying this information? (Answers received on only 50 returns)	50	50
Do our salesmen and our proposals and literature give you sufficient information to present and sell your management or board of directors?	86	14

Rate our present selling based on your contacts, thinking in terms of majority of salesmen (Dealer, Factory, Direct Salesmen, Sales Engineers from factories).

a-100 18
b-90 27
c-75 55
d-50 0
e-40 0
f-25 0

100 indicates very good—Mark X after rating.

The Effect of Quantity on Machine Selection

By J. R. WEAVER, works manager, Westinghouse Electric Corp.

BASICALLY, there are only three types of requirements which create a need for a new machine tool: 1) replacement of obsolete equipment; 2) development of new products, expansion of existing production facilities or both; and 3) cost reduction.

A good replacement plan will show up machines not operating efficiently. Further analysis often will show that these machines can be replaced to make additional savings. Some of the more stable newer industries, not yet faced by obsolescence problems, should be familiarized with the facts of life on replacements.

There is no simple fixed rule about replacements. The best replacement plan will not do much more than bring up individual cases for consideration at the proper time. Sales engineers should be aware that the buyer plays a major role in developing and following through with a replacement plan. To do the best job, he needs the help of sales engineers who understand his objectives.

At East Springfield we have learned the wisdom of maintaining a cost reduction group. The engineers in this department are continually poring over product designs and methods to squeeze out the last mill of unnecessary manufacturing expense.

General-purpose machines are bought today pretty much the way you and I buy an automobile. We have enough confidence in reliable manufacturers that we rarely question the efficiency of the motor or the gear ratio of the transmission. Instead we buy what we can afford, with consideration given to external characteristics. The sales story might well concern the versatility of application and simplicity of operation. Most important, if your equipment eliminates operator effort and skill, tell the buyer about it. Keep in mind that operator training time as well as maintenance, goes into manufacturing expense, thereby narrowing the market for a company's product. In most applications where flexibility of equipment is called for, you will find more highly skilled operators are assigned to the machines.

The job shop buyer expects the sales engineer to know feeds, speeds, power, cam arrangement and machineability of metal, in addition to understanding the application of ingenious fixtures and jigs to his product. The major effect of small quantity runs is to influence the buyer to look primarily for flexibility.

The buyer for a functionally laid-out plant is continually considering the use of special-purpose equipment, and dreams of setting up his whole plant for line production. He must study the cyclical behavior of the part to be machined. He therefore is obliged to know intimately how and when the complete apparatus is sold. If his plant produces two or more similar products which have seasonally varying selling characteristics, his problem is further complicated until he determines his maximum requirements when the cycles overlap. In deciding machine loads, the buyer must know the machine down-time for tool changes and maintenance.

Whether to use special-purpose or general-purpose equipment requires consideration of parts handling. One of the most important advancements in the machine tool industry is application of automatic transfer mechanisms to production equipment. Standard drilling, tapping and milling units arranged in line, or so as to present all surfaces of the particular part for machining, eliminate handling. Automatic transfer equipment is of special interest to the buyer when parts are awkward.

At Westinghouse we are emphasizing work-loading and ejecting devices. First, we are interested in reducing manual effort and fatigue to give the operator more time for point of operation inspection of quality control. Second, we know that dial feeds, magazines and other automatic devices keep the machines working with less down-time between cycles. We want the most out of our investment, which averages about $6,000 per employee.

Another essential feature of equip- conveyorized chip removal. These quantities of chips often are measured in tons and special salvage operations are necessary for economy.

The very character of mass production industries explains the effect of quantity on machine selections. Mass production is profitable only because of the existence of mass markets. Mass markets can be obtained and expanded only by reducing costs. The most important factor then is not necessarily the price of the machine selected, nor its flexibility, but the price at which it will produce the part.

There is danger in overemphasis of personality in machine tool buying and selling. We could do with less of the psychology of selling and more with an intense spirit of service. Machine tool sales engineers will find that more and more they will be talking and selling their ideas to time study and methods engineers. I strongly recommend a study and knowledge of fundamentals of incentive systems by all sales engineers. A sales engineer also should concern himself with the kind of accounting by which a manufacturer determines his costs and factory budgets.

Buying is not a one-man operation. Much of the operational policy in today's business is decided in conferences and committees. If the meeting is about machine tools, the sales engineer and his entire organization may be represented only by the buyer.

The "Faculty" on July 20 (left to right) F. L. Armstrong, Marshall & Huschart Co.; C. Denson Day, Norton Co.; J. A. Raterman, Monarch Machine Tool Co.; E. J. Seifreat, Seifreat-Elstad Machinery Co.; S. E. Bergstrom, Cincinnati Milling & Grinding Machines, Inc.; A. B. Kettle, Austin-Hastings Co.

Tooling Up the Job

By ROBERT B. HAYES, works manager, Spicer Mfg. Div., Dana Corp.

FIRST we must define the job to be tooled. We must know who is going to use the tools. There is a big difference between tooling a job for a group of experienced operators and foremen in an established plant, and tooling the same job in a new plant with new employees and new foremen. It is equally important to know what kind of an organization is going to control the tools and their functions. The answer may well determine the kind of tooling.

No matter what the job, the first step is preparing an estimate. This should be done even if the tooling is only for a single operation. The initial estimate consists of picking a figure from the air or scanning the job quickly. It always is followed by a detailed analysis. Picking the figure from the air is done from an outline drawing of the product. About one-fourth of our tooling programs are based on this sort of an estimate. The quick-scanning method starts with a reasonably complete assembly drawing of the product, then proceeds to a semi-detailed count of the operations required, and continues to a multiplication of a rule-of-thumb figure for tools per operation by number of operations. The cost of floor space and of other equipment is added. This type of estimate is completed in a few days and accounts for half or more of our tooling.

All jobs wind up with a formal detailed estimate from detailed engineering prints. It is from this last analysis that designs and purchases are made. Determination of the type of machine tool is made from two separate sets of facts. First phase is concerned with what the machine should do; the second is to decide who shall build the machine.

Deciding what the machine should do requires a marshalling of many facts, some of which have little connection with the new job being tooled. One must consider the restrictions on holding the part while the work is being done. With some parts on some operations, the part may be held in such manner that clamps and locating devices will not interfere with tool spindles, and operations may be performed in several planes at the same time or in consecutive sequence.

Quantity of parts to be produced in a unit of time is all-important. It is not enough to include only the quantity of the new part for which the machine is being bought. It is necessary to scan parts already in production which are similar to the new part and which might be in the combination of operations. It also is desirable to weigh potential future parts which may be processed over the equipment. In any consideration of combining operations, the question of loading time and transfer time as compared with machine cycle time is important.

Not the least factor in combining operations is quality. Frequently two or more holes or surfaces have to be machined in such accurate relationship to each other that any attempt to produce them in separate operations with separate loadings of the part is doomed to disaster. In such cases, operation combination is mandatory. Finally, it is essential to examine the practicality of the combination. The combination must be of such nature that the effectiveness and accuracy of individual operations is not impaired. From many angles it is best to start with the assumption that the rotating or index type of machine should be selected unless other conditions prohibit it to speed up production.

Special machines are useful to other users than just high-volume producers. If one must choose between four standard machines totaling $8,000 and a special machine at $13,000, selection should be made on the basis of what one gets for the extra $5,000. It is astonishing how frequently the extra expenditure is worthwhile. There is need in every tooling program to study the feasibility of using special machinery.

The machine tool builder should be called upon to declare that his machine will have the power, rigidity, accuracy and range of speeds, feeds, and motions to do the work the master mechanic wants done. How much of such work the master mechanic gets from the machine, however, is his responsibility. We rarely pay attention to the delivery date in the quotation, but we do to the date given us directly by the representative of the builder.

Responsibility of the Machine Tool Builder to the Machine Tool Distributor

By GEORGE HABICHT, JR., president Marshall & Huschart Machinery Co., Chicago

THE distributor is the sales division of the machine tool builder's business. He is in constant touch with the user of the builder's product and sees it in operation under all sorts of conditions. Suggestions from the distributor should be considered when addition of new machines to a line are contemplated.

The distributor should be informed promptly of any design changes of new attachments, and of new job applications. This will enable him to survey his territory for similar potential applications.

The sales engineer sent out by the manufacturer should be an expert on his own machines and be able to answer any question propounded by skeptical mechanics promptly and intelligently and convincingly. He should have a good working knowledge of general machine shop practices. He should be capable of making preliminary production estimates right on the job. He must remember that the salesman has usually built him up in the eyes of the buyer whom they are to see as an expert and that he has his big opportunity when he is across the desk from him and must be able to justify that reputation to gain the buyer's quick confidence. Finally, he must be able to sell himself to the distributor's salesmen as the manufacturer's representative because in many cases that is the only contact the manufacturer has with the individual salesmen. It takes a good man to do these things.

After the machine is delivered, the distributor has to keep it sold, and in this has to depend to a great extent on factory service. This is a most important part of the sales job. Service men should follow the distributor's guidance. When complaints are made, the builder must render the kind of service he expects to get when he buys machines for his own shop. Then service men will insure satisfaction and help the distributor get repeat orders.

The manufacturer should train a competent individual in his organization in the important duty of taking charge of distributor's salesmen when they visit the factory for further knowledge and instruction, so that their time is utilized to the greatest mutual advantage. These visits should be planned in advance and a regular course of procedure laid out and followed rigidly. The instructions should start on time in the morning, and each step in the program should be timed and this schedule should be maintained.

Your factory sales engineers and service men can assist this educational program by reviewing your line with the distributor salesmen every time they are in the territory.

The whole premise of the distributor method of sales is a two-unit team. There must be complete cooperation between the members of the team, each keeping the other fully informed at all times to prevent confusion.

A. G. Bryant, NMTBA president, discusses the course with Tell Berna, association general manager; Dan Harrington, Harrington, Wilson, Brown & Co.; J. F. Owens, Jr., J. F. Owens Machinery Co.; D. R. Weedon, Blanchard Machine Co.; H. L. Tigges, Baker Bros., Inc.

The Technique of a Sales Engineering Interview

By E. B. MacDONALD, vice president, Machine Tool Division, Syracuse Supply Co.

YOUR approach to the customer is an important part of your interview. The wrong approach may result in no interview at all, or a very poor one may take many additional calls to overcome.

It seems to me that interviews can be classified into three or possibly four different groups.

A missionary call should create a desire in the buyer's mind for a machine tool that you want to sell him. It must be a machine that he can use or requires. Never try to make a missionary call without talking about a definite machine.

By simply exposing yourself to prospective customers, you will find some who will force you to take an inquiry and even give you orders. In a surprising number of cases you will find your prospect saying: "This is a nice machine and we probably could use one, but right now we need such-and-such a machine much more." That's your cue. A direct inquiry for an immediate need.

At this point, catalogs can be used to give a general picture of the machine. Then go through the machine's features showing cutaways or rollouts. It is better to emphasize customer benefits than machine features. Let the customer express his opinion. Don't try to smother him with a set talk. If you can put the purchaser's benefits in dollars you will help him get an appropriation to buy.

On prints, be sure that the material is clearly specified. If the specification number is not well known, get the analysis; better still get the surface feet at which customer is machining and whether he is using high-speed steel or cemented carbide tools. Be sure tolerances are plainly shown. Get location points, where the part may be chucked, whether roughing and finishing cuts are necessary, whether the close tolerances are going to be ground afterward.

Does the customer prefer high-speed or cemented carbide tools? How many pieces are required in a given time? Is the monthly or yearly requirement high? This will help to determine how extensive the tooling should be.

Can the lots be increased if the setup time is long? Can you run six months' production instead of three months'? Can line parts, like pins or washers of assorted sizes, be grouped so as to minimize setup time?

Find out as nearly as possible how the job is now being run. With the proper information available with your inquiry, your production engineers can make an intelligent layout and proposal.

The follow-up interview uses many of the techniques already discussed, particularly in regard to the approach. Have as much information as possible with regard to the proposal so as to be able to answer any questions.

On the closing call we make the final plunge to get the order. We review all the benefits the customer will get. Find out if he considers them sufficient to warrant the purchase price. If production figures are doubted, get a recheck from factory engineers. Have a list of satisfied users in or out of your territory that he knows and respects. Perhaps the buyer may have to borrow money to pay for the equipment. You should, therefore, have a speaking acquaintance with his profit-and-loss statements and current depreciation rates, be able to figure interest on borrowings, and show possible savings.

You can make or break a customer's confidence in you by the attitude you take in the service call. Such a call does these things: (1) gets the machine into service quickly, (2) impresses the customer with your knowledge, (3) gives him confidence in your ability, (4) teaches him to rely on you, (5) saves factory expense of a service man, (6) gives factory confidence in you, (7) increases your knowledge, (8) gives you confidence in yourself.

If you can't overcome the trouble, give the factory a first-hand account of the trouble, help select the right man to send, see that the necessary parts are sent, and perhaps improvise a way to use the machine.

What Does It Cost to Sell?

By THOMAS R. RUDEL, president, Rudel Machinery Co.

SALES training in our industry is often haphazard, with too much emphasis given to the personality of the embryonic salesman. By the same token, his so-called sales training too often consists of an apprenticeship as a service man, a short tour at the plant, or graduation from a clerical job in one of the various departments, either of the manufacturer or of the distributor organization.

Too little time and effort are spent teaching him the number of man-hours necessary to produce specific amounts of dollar sales, and to understand that because of unplanned effort on his part he may spend his time in such a way as to lose heavily for his company. By contrast, no shop can long exist competitively without a production control system, with each day's work planned well in advance.

When you are out selling for your organization and spending its time and money, you are in effect a purchasing agent for your employer and it is, therefore, expected of you to get the most possible for the money which has already been spent on you in advance.

Selling Tools

By B. N. BROCKMAN, vice president and sales manager R. K. LeBlond Machine Tool Co.

BETTER selling must be secured by better planning. To begin with, we must select the right man to do the sales job. We must train him adequately. We must know where our market is. And we must make sure that when we are ready to go after the order, we equip the sales engineer with the tools so that he can do his work effectively. Without the proper selling equipment, you might as well be on a tour of the territory at company expense.

Personality and a thorough understanding of his machine are fundamental for the salesman, but hardly enough for the man who sells mechanical equipment. He needs samples. He needs models, photographs, the ability to make a simple sketch. He needs catalogs, circulars, booklets. He needs advertising, preprints, direct mail, performance records, testimonial letters, and sometimes slides or movies.

For certain types of machines, samples are effective. Remember, many of your customers absorb information more quickly and easily through their eyes and fingers than through their ears. A small-scale model of a machine that can be put on the customer's desk is far better than photographs. It may be of painted wood; it need not be operable.

A photograph album is an excellent selling tool. Photographs must be carefully taken to bring out just what the salesman intends to say, and never should be retouched. A slide film is a photograph album in a different form. It is better when you must talk to more than one prospect. The simplest selling tool of all—free-hand sketches—is much neglected. It is the best way to bring out a detail of a tool, a fixture, a machine. The most useful tool is the general catalog which outlines practically all the machines we build. As a rule, catalogs are the rustiest, saddest and most abused medium of information. The common denominator of any catalog can be reduced to this question: "Does it sell?" Catalogs, like salesmen, need to revise their selling tactics periodically. They should be overhauled for selling effect.

Circulars sometimes are the deciding factor in a sale. They must tell at a glance what the buyer will get. As much printed salesmanship as possible should be packed into each one. Last year we tried a transvision portrayal of our dual-drive lathe—we dubbed it "The Silent Salesman"—and it became one of the most important sales tools we have ever furnished our field men. It is a three-dimensional transparency in five colors. It is more revealing than motion pictures, photographs, charts, blueprints, or any combination of these media.

Advertising performs the preliminary steps in the manufacturing of an order. It permits a sales engineer to concentrate his limited time on the job that he alone can do best, namely, close the sale. Advertising will accomplish something more quickly and effectively than could be achieved by any number of salesmen. It is a selling tool and a mechanical tool, a high-speed tool and a low-cost tool. Well used, it capably accomplishes the first three of the five steps to the building of the order: contact, interest and preference. Advertising is the man who can make hundreds of calls simultaneously and who can contact hundreds of prospects cheaply, quickly and at regular intervals. But advertising is not a useful instrument unless it is the right kind. Advertisements should be sales talks in print.

Performance records are the heart of effective selling and advertising. Testimonial letters too should be used, also reprints of effective articles in trade papers. A sales news portfolio sent monthly to the sales force is a good medium. Many sales training subjects, topics of statistical or graphic nature can be presented well with slides. Also, salesminded men are finding in the movie the tool they need to meet prospects' demands for the complete story without waste of time. The movie will help new sales engineers learn more quickly and will teach seasoned sales engineers many new tricks. The big disadvantage is the cost.

A cardinal principle in successful selling lies in a sales engineer's attitude toward his customer. Instead of figuring out how to sell him, the sales engineer should have in mind why the customer should buy. Supply the right answers to that and the customer will close the sale for you without extra talk.

Sales Strategy

By SWAN E. BERGSTROM, vice president, Cincinnati Milling & Grinding Machines, Inc.

SALES are lost in the machine tool industry by seasoned machine tool salesmen because they do not go in to their customer with a planned, organized presentation of the product that they have to sell. They assume that the customer knows as much about their product as they do themselves. They do not bring into the open some of the important features of their machine that will produce money for the customer.

Hundreds of machine tool salesmen dominate the interview with the customer by doing all the talking, selling him on the product and then unselling him by talking too much and making too extravagant claims.

A machine tool salesman should be a long-range salesman. The buyer often buys from the salesman in whose honesty, integrity and sincerity he has implicit confidence. Exaggerated claims and knocking your competitor will lose orders.

The one thing that we have missed in our industry is the ability of our selling organizations to generate enough desire for new machine tools to keep the average age at a reasonable level.

A salesman must have an organized presentation plan, call on the customer whether there is a hot deal pending or not, and know the time to put on the closing act. One of the biggest points in selling is to know when to ask for the order. To lose the sale because your price is too high is an indictment of your ability to use the proper sales strategy. It is an indictment of the salesman for not doing a good job.

If a salesman has a complaint to handle he should make that his first order of business because a complaint in his territory on any of his equipment is never a sales asset.

Certain fundamental sales principles are outlined by Borden and Busse in their book, "How to Win a Sales Argument":

(1) don't try to do all the talking yourself; (2) don't interrupt your customer. Give him a chance to talk; (3) avoid an argumentative attitude that is belligerently positive; (4) in the first half of your interview, inquire rather than attack; (5) when your customer makes a statement, restate clearly and vigorously in your own words the gist of each statement that your customer advances as soon as he advances it so that he will know that you understand what he is saying; (6) identify your main sales argument with one key issue, then stick to that issue and don't digress.

Selling strategy breaks down into two points. First you have a sales army in which you plan the strategy, and in that sales army you want people who will live up to the three basic selling qualifications of sincerity, courtesy and service. Then you must train your army so that it will apply sales tactics which will eliminate lost-deal reports. By continual application of the six principles of selling strategy, your salesmen will be their own strategists and can shift the strategy, whenever they are in a sales battle, to get the order.

Responsibility of Machine Tool Distributor to Machine Tool Builder

By L. W. SCOTT ALTER, president and general manager, American Tool Works

LIKE the family doctor, the distributor's salesman knows his customers intimately. Since he has a variety of things this customer needs, he has frequent contacts. He learns the buyer's likes and dislikes, and becomes familiar with his plant equipment, its strengths and its weaknesses. True, a man who sells a variety of machines can't be as expert concerning any one machine as a specialist is. However, there is always a factory expert who can be called in, if and when the going gets too heavy.

If a customer has a job, or a series of jobs to do, there may be several approaches, using perhaps entirely different machines. The distributor's salesman knows something about all of them and can point out the different approaches to his customer. Summing up, the distributor's salesman develops close relations with a relatively few customers. He specializes on them. Their needs are his needs, no matter what direction they may take.

Teamwork between factory representatives and the distributor salesman is of the utmost importance. Distributor salesmen should be given every opportunity to perfect their understanding of the machines they are selling, through meetings in the distributor's headquarters, through visits to the builder's plant and through actual selling alongside factory engineers and officials.

The salesmen should invariably check up on all their new installations, to evidence the proper interest in this user's satisfaction with the purchase. Serious complaints should be thoroughly investigated by the salesman, so that in reporting same to the manufacturer, he can fully explain the difficulty involved. Such reports should be promptly made. If any repair parts are needed, these should be stressed so that the service man does not arrive on the scene empty-handed and therefore unable to go ahead with his work.

The Sales Engineer's Daily Activity

By R. A. VIDINGHOFF, vice president, Swind Machinery Co.

A SUCCESSFUL sales engineer must have a plan of operation and some control over it. His day is divided between the amount of time spent in the office and the amount spent in the field. The time in the office is not lost because it is where your controls are located.

Our business, like most others, is dependent on records—records of inquiries, of current orders, or past orders, of general correspondence, records that contain all the details about our equipment, service reports. Even if the salesman doesn't keep these records, he should familiarize himself with them so that he will know where the information is.

You can keep selling costs down by minimizing lost time in the office. We encourage the use of the phone wherever good judgment indicates its use. However, anything of importance should be confirmed in writing. A phone call can be impressive and effective if used wisely. Some offices use the teletype system, which has obvious advantages over correspondence. It is faster, it provides a written record, and eliminates the need for confirmation.

Each salesman always should have a copy of the mailing list for his territory on his desk. When he makes out his reports, it is easy to check the companies and individuals called on against this list and make corrections or additions. When he leaves the office, he should leave a list of intended calls.

Meeting Objections

By J. F. MILLER, sales manager, Machine Tool and Cutting Tool Divisions, Ex-Cell-O Corp.

THE only long-range, satisfactory method of initiating sales is to get down in the customer's shop, know the equipment, and know the foreman. A careful study of actual shop conditions will bring to the front any complaints about earlier machines.

The sales representative himself may have created ill-will. The sales manager should stay close enough to his men to insist that such cases be reported. In many cases the trouble has arisen from a misunderstanding and can be straightened out quickly. In other cases, the account has to be handled temporarily direct from the home office.

The sales engineer frequently becomes the victim of inter-plant or inter-departmental jealousies, ambitions, or animosities which prevent sales. This is a case where the sales engineer must direct the competition into a study of methods and tooling, rather than builders' names.

Objections related to design arise at the time of ordering. Speeds, feeds, construction of the machine or fixture, and the production result, are major selling problems. But here again the sales engineer must know the answer.

Meeting objections is emergency selling. It reminds us of a fire truck needed only in case of fire. The sales engineer doing his job is working all the time to prevent formation of objections. It is our job and responsibility to keep his mind always on the thought and to erradicate objections as speedily as possible.

The Written Word

By C. DENSON DAY, sales manager, Norton Co., Grinding Machine Division

THE written proposal is the silent salesman. In the absence of his personality, powers of persuasion and ability to answer questions, it must work for the salesman and complete the job of getting the order.

A proposal-quotation-bid-proposition—is the written presentation of an offer to sell. To do its job properly it should possess the elements which lead to a sale: it should attract, interest, convince and sell.

Each proposal has four basic elements: (1) the quotation itself specifying the machine, equipment, prices and terms; (2) the catalog or specification sheet describing and illustrating the equipment; (3) the covering letter; and (4) the proposal cover.

In preparing the proposal, you should consider the psychology involved in dealing with the customer, then point your proposal and letter toward that mark. If I were to receive the proposal, what would I want? I am important in this transaction—has my viewpoint been considered? Does the proposal cover the exact equipment discussed? Is the alternate method the foreman suggested covered by another proposal? How am I going to give my boss the right arguments to get this machine ordered?

You should include a blueprint of the part involved and a covering letter with the proposal. Last is the specification sheet, catalog or bulletin. Promptness of preparation and delivery is vital to hold the customer's interest. In "program buying" each machine quotation is one of chain; a missing link can have a serious and disturbing influence on the process engineer of buyer. Poor typing leaves a bad impression. The proposal cover or binder should be neat and orderly in appearance.

The personal element and tone in the letter is important. The proposal is one of our principal selling tools. As such it should be well designed, properly constructed and sharp.

Analyzing Failure

By JEROME A. RATERMAN, president Monarch Machine Tool Co.

THE average number of calls made by a sales engineer is 425 per year. Average yearly expense of a sales engineer is over $16,000. The average length of a call is 30 min. and the cost of each call is $38. Thus the subject—analyzing failure—is pretty important.

Common reasons for losing orders are: 1) the product, 2) marketing conditions, 3) administration of sales, and 4) the salesman. Buyers are not infallible in selecting machine tool equipment. The salesman is treading dangerous ground when he does not try to help the buyer select the type of equipment required. Better to lose an order than sell a piece of equipment unsuitable for the job.

A salesman's success can be very limited unless he is properly backed up at home. Proposals must be prompt and complete. A short quotation is insufficient; every selling argument should be in the proposal. Sales literature should be attractive. No manufacturer can justify cheap bulletins. No salesman can be expected to get an order if his firm has not taken an active interest in the satisfactory performance of previous installations.

Correspondence must be courteous. Few people any longer appear to have the knack of conveying in writing as favorable impressions as they create in conversation. Sales policies of manufacturers and dealers should be thoroughly established and understood by salesmen. It is essential that advertising be coordinated with sales efforts. The sales quota must be put within reasonable reach, and territories or accounts should be of proper size to provide a reliable measure of performance. The salesman should be properly selected, trained and compensated.

How to Sell to the Government

By E. C. ADAMS, vice president, Van Norman Co.

SELLING to a government department is different from selling to an industrial concern. Your industrial customer usually does not open bids at a certain hour on a certain day. Government officials operate under a definite set of rules intended to assure impartial buying. They also are intended to make a clean-cut record of why the purchase was made so that the official need not fear criticism of his action.

In the first group of limitations on government buying are stipulations which come from laws passed by Congress. No good end is served by complaining to a government official about them. If you cannot comply, don't quote. In the second category are stipulations which arise from exercise of judgment by the buying officials or department, on such details as the capacity of a machine, number of feeds or speeds as a minimum, attachments to be furnished. These can be changed, but never after invitations to bid are mailed out.

Find out where the departments are that can use your machine. The men in charge of the shops are qualified practical men. They want to be kept informed of what is new. See that the uniformed officers and civilian chiefs are kept informed too. Procurement officers with civilian assistants should be advised and provided with up-to-date circulars and catalogs.

Show how specifications can be written to allow you to quote on your machine. They want competition—at least three acceptable bids, and as many more as they can get. But do not suggest details that will rule out a qualified competitor. When you receive an invitation to bid, look first to see the date on which bids will be opened. If your bid is late, you are out of luck. Then study the specifications and see whether you can quote. Read every word with greatest care. If a sentence can be interpreted two ways, offer a bid on one interpretation and an alternate bid on the other. Even if you cannot conform literally, it may be advisable to submit an alternate bid explaining simply and clearly how your machine differs from specifications and why it is suitable for the job.

The bidder with the lowest price does not always get a government order. He may not qualify; he may have overlooked something. If you win out and Washington sends you a contract, that is what you must furnish. If you forgot to add the motor into your price, you are stuck. If you do not get the award, don't complain. Just make sure the job was handled right and concentrate on the next one.

Handling Sales to Multi-Plant Customers

By EDWARD W. VOSS, president, Voss Machinery Co.

COORDINATION of efforts by distributors and sales engineers in various areas is essential in handling sales to multi-plant customers. This is becoming more important daily due to centralized purchasing, mergers and the more efficient streamlining of executive personnel in our larger corporations.

The multi-plant company must be analyzed, all plants spotted and a program developed for handling the account. The personnel and manufacturing problems must be studied, proper names and titles obtained of persons in these large concerns who have authority to make preliminary studies of problems, and prepare appropriation requests.

The next important problem is to convince the customer that a coordinated operation is for his benefit. Through the cooperation of the suppliers and distributors, we can really do this work. This effort takes time. Time is money and it will entail for some organizations extra help, but it will pay real dividends if the details are worked out.

Our customer does not care how the sales profit is divided, or which distributor's office gets the commission. He is only interested in getting the most for his money, the best type of service from a maintenance standpoint and in engineering the job, or job changes, which will come up from time to time.

The Follow-Through After the Sale

By DAN HARRINGTON, president, Harrington, Wilson, Brown & Co.

IF YOU are the right kind of salesman, you know exactly what the customer requires; therefore you should carefully check the order to make sure that everything needed is on it. You also should check the electrical characteristics to see that the motor will conform to the current available.

If you are a distributor-salesman, you or someone in your office must follow through to be sure that the manufacturer keeps the delivery promise. If delivery is delayed, you should tell the customer immediately.

Shipping involves many problems which just can't be guessed at. You should keep yourself informed of the cheapest and best way to ship. You should know when the machine is delivered and be there at the time. It is your job as a salesman to be a liaison man between these men and your customer. Coach the factory erector or demonstrator so that when he arrives at the plant, he knows how to conduct himself. Be sure the machine operates in accordance with the customer's expectations; that the demonstrator stays on the job until the customer is satisfied. Be sure the operator is on your side.

The follow-through after the sale breeds satisfied customers.

It's the FACTS that count

PRODUCTS of quality have in them many intangibles like experience, workmanship, reputation and all the rest. But quality itself is a sometime thing. Crowing about it isn't enough. It must be backed by tangibles, by cold hard facts. Threadwell quality in taps is backed by these facts:

Ground radial relief for elimination of binding and breakage.

Ground *and* polished flutes for quick and easy chip removal without clogging.

Oxygen proof heat treatment for uniformity of molecular structure and hardness of the steel.

Cold tempering for increasing wear life.

Threads ground from solid for uniform thread structure from crest to root.

Greaseless rust-proofing for tap protection and for cleaner handling.

Color dots on shank for quick identification and selection of right tap.

Plastic tap capsule for protection against dirt and careless handling.

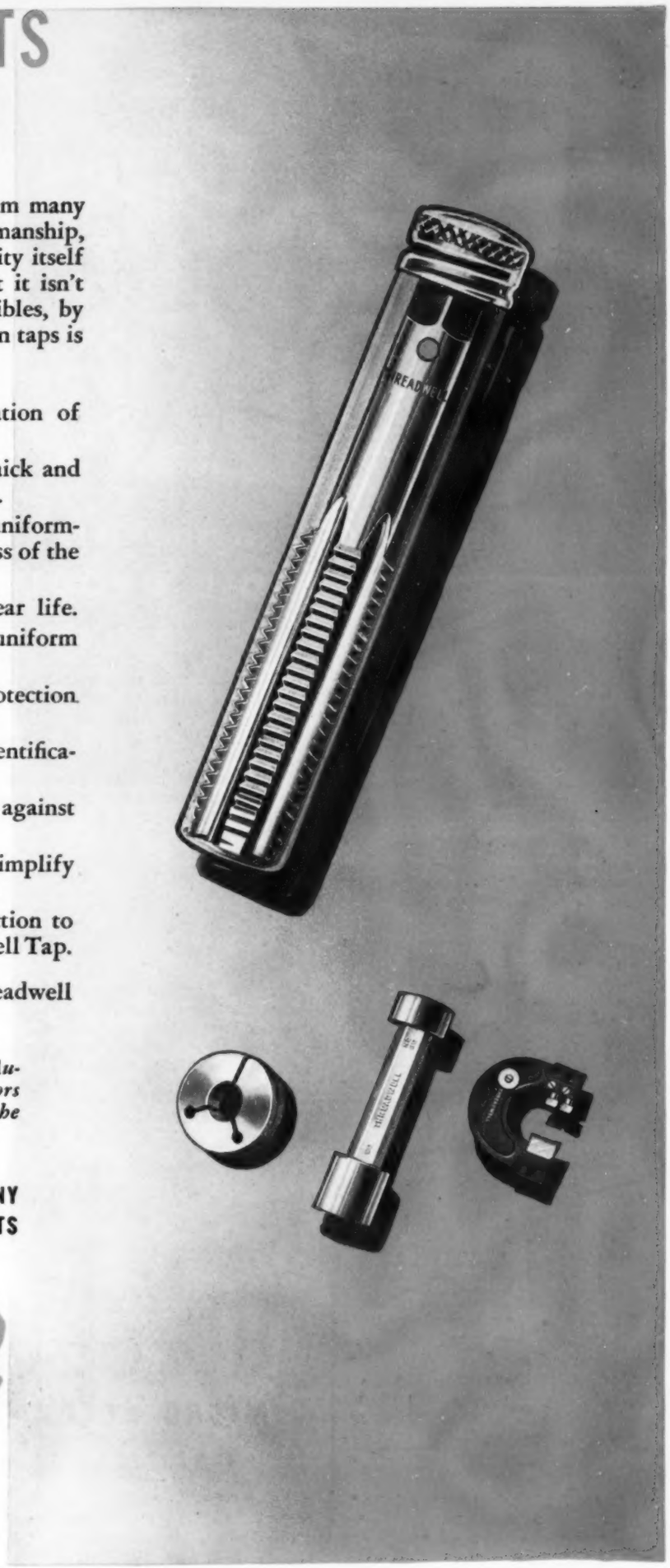
Inventory control on package to simplify storage and checking in the tool crib.

Process and individual final inspection to guarantee the quality of each Threadwell Tap.

Investigate also the facts on Threadwell Fixed Gages.

Sold exclusively by Threadwell Authorized Stock Carrying Distributors throughout the United States and the world.

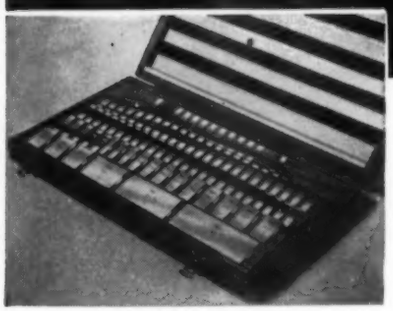
THREADWELL TAP AND DIE COMPANY
GREENFIELD MASSACHUSETTS



Threadwell

"TOOLS OF DISTINCTION"

here are two booklets that can help you AVOID PRODUCTION DELAYS



84B—84 block set (steel)
Accuracy: .000008....$235.00

Angle Gage Blocks increase speed and precision of angle inspection.

Delays due to changes in design and procedure can raise havoc with production schedules particularly if special gages are necessary before work can proceed.

Delivery of plug, ring, angle gages, indexing plates and dividing heads can be days away, yet a simple precaution can avoid this holdup.

Webber Angle Gage Blocks and Fixtures and Heavy Duty Blocks and Fixtures provide the answer. They fill so many purposes in this direction that production is rarely held up for lack of precise dimensional controls.

Some of the more important applications are detailed in the booklets shown above; other applications suggest themselves after quick inspection.

Send for these booklets and learn how dimensional short cuts can easily clip days off your delivery schedule.

WEBBER GAGE COMPANY
12901 Triskett Rd., Cleveland 11, Ohio

These are the direct factory representatives who can tell you about the advances in precision measurement that Webber has made possible.

GEO. SCHERR CO.,
200 Lafayette Street,
New York 12, N. Y.
Canal 6-3512

* * *

Exclusive Canadian Distributor
H. C. BURTON CO., LTD.
166-168 Rebecca Street,
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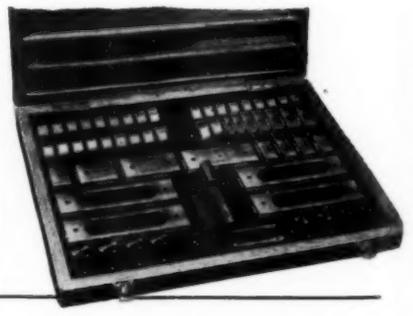
Carblox Wear Gages add the wearing qualities of carbide to any standard steel block set. Two sizes $21.50 and $27.50.

Webber
MICRO-ACCURATE GAGE BLOCKS and FIXTURES

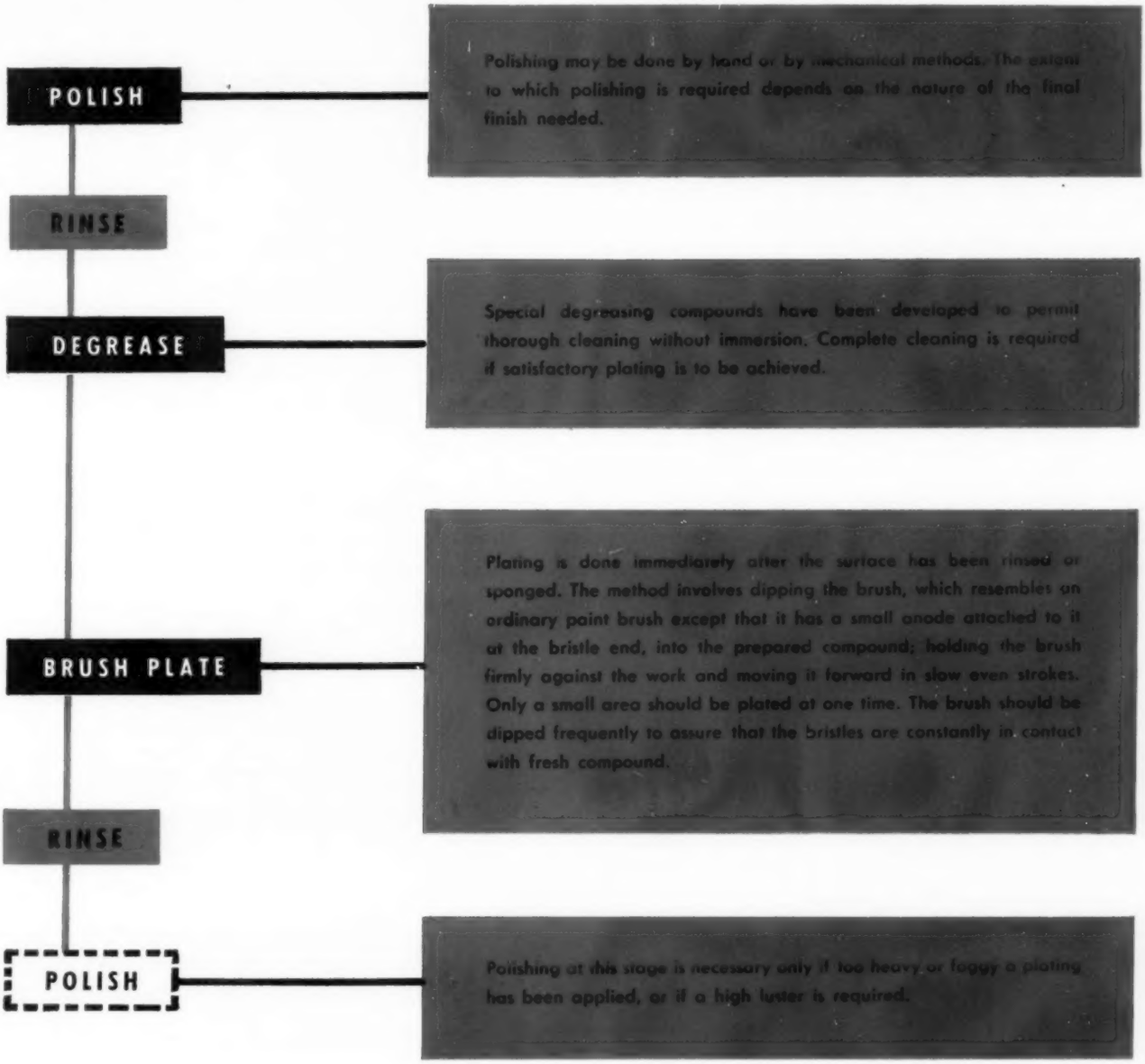


Transferring the extreme precision of gage blocks directly to the work without time taking precautions is one of the outstanding advantages of Webber Heavy Duty Gage Blocks and Fixtures.

Process Sheet for Brush Electroplating

BY GEORGE BLACK

ALTHOUGH not a substitute for tank or barrel electroplating, the brush method of deposition has proved a valuable supplement, especially when it is necessary to plate a small portion of an assembly that cannot conveniently be dismantled nor safely immersed. Gold, nickel, silver, copper, cadmium and, to some extent, chromium have been satisfactorily deposited through the use of prepared compounds of jelly-like consistency. Home workshops, electrical and radio shops, experimental laboratories, garages and a variety of manufacturing firms have found these portable, inexpensive units of inestimable value for the plating of small surfaces and limited quantities of work. Brush electroplating sets range from simple battery-operated units which sell for a few dollars, to more elaborate types for power operation.


POLISH
Polishing may be done by hand or by mechanical methods. The extent to which polishing is required depends on the nature of the final finish needed.
RINSE
DEGREASE
Special degreasing compounds have been developed to permit thorough cleaning without immersion. Complete cleaning is required if satisfactory plating is to be achieved.
BRUSH PLATE
Plating is done immediately after the surface has been rinsed or sponged. The method involves dipping the brush, which resembles an ordinary paint brush except that it has a small anode attached to it at the bristle end, into the prepared compound; holding the brush firmly against the work and moving it forward in slow even strokes. Only a small area should be plated at one time. The brush should be dipped frequently to assure that the bristles are constantly in contact with fresh compound.
RINSE
POLISH
Polishing at this stage is necessary only if too heavy or foggy a plating has been applied, or if a high luster is required.

BELIEVE
your Engineers and Designers

BEFORE VIBRATION
It's tight because it was wrenched Tight
...specify Kantlink Spring Washers on all bolted constructions
AFTER VIBRATION
It's still tight because a Kantlink expanded and held it Tight

Alert engineers will tell you that all mechanisms, machines or products in which there are bolted assemblies will loosen soon, unless you use spring washers.

They will tell you that a nut cannot turn on its bolt while there is pressure on the threads. But the other parts of assemblies wear down and loosen unless spring power is used to expand and hold all parts tight longer.

Everything that vibrates—no matter how little—loosens eventually. Always has, always will. Looseness costs money, and often causes damage.

Avoid this unnecessary looseness by using Kantlink Spring Washers. Millions are being used today; but still there are hundreds of places where these strong safety devices can increase the value and efficiency of unprotected products and machines.

Write for descriptive folders today.

Originators of KANTLINK the long-range spring washer

THE NATIONAL LOCK WASHER COMPANY
Newark 5, New Jersey **Milwaukee 2, Wisconsin**

Hangers for Electrostatic Painting — I

BY DR. EMERY P. MILLER,
RANSBURG ELECTRO-COATING CORPORATION

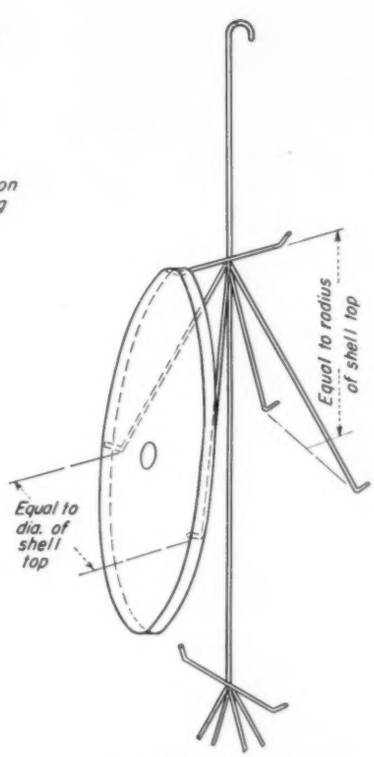
Every electrostatic paint-spraying system has a conveyor of some kind to transport the workpieces through the charged spray zone. Hangers for electrostatic painting follow the designs used in other paint-spray installations, except that a wide latitude of work positioning is possible because of the extended precipitating action of the field and its abilty to cause surfaces to be coated even though not in the direct path of the sprayed material.

Requirements in hanger design can be summarized thus:

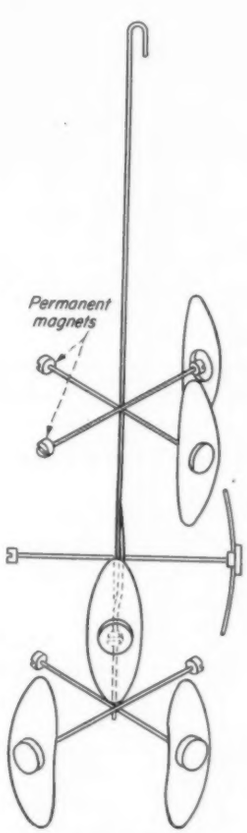
1. The parts must be transported and removed without marring.
2. Good electrical contact must be maintained between the conveyor and the workpieces.
3. Workpieces must be supported so surfaces to be painted are exposed to the field.
4. Workpieces should occupy the major portion of the "envelope of rotation" about the axis of the hanger.
5. Spacing between parts on each hanger and between suceeding hangers is important.
6. Support grooved or contoured parts on the hanger so these are parallel to conveyor travel.

Hangers shown in the accompanying illustrations indicate the wide variety of designs that have proved practical. Principles of operation and equipment used for electrostatic spray-painting systems were discussed in *A.M.*, June 20, 1946, pages 141-144.

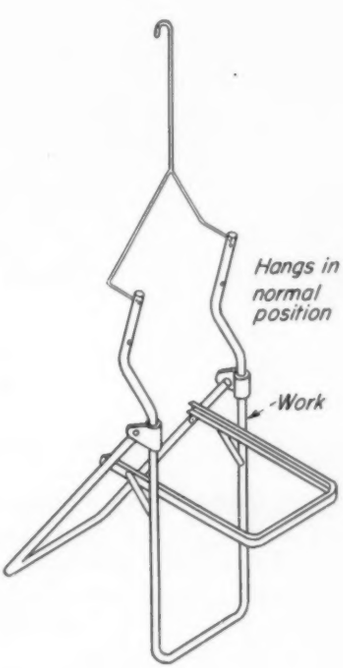
Three workpieces are supported on a wire hanger, which is rotated in the spray zone by contact of a drum on the conveyor carrier with a bar faced with friction material

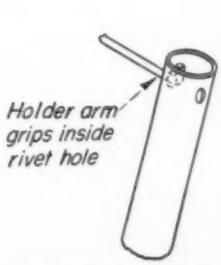


Special hanger for coating exterior surfaces of water-heater tops. Each hanger carries four workpieces tilted for easy loading and unloading in two staggered tiers. Minimum clearance between workpieces is 3 in. so proper field can be developed

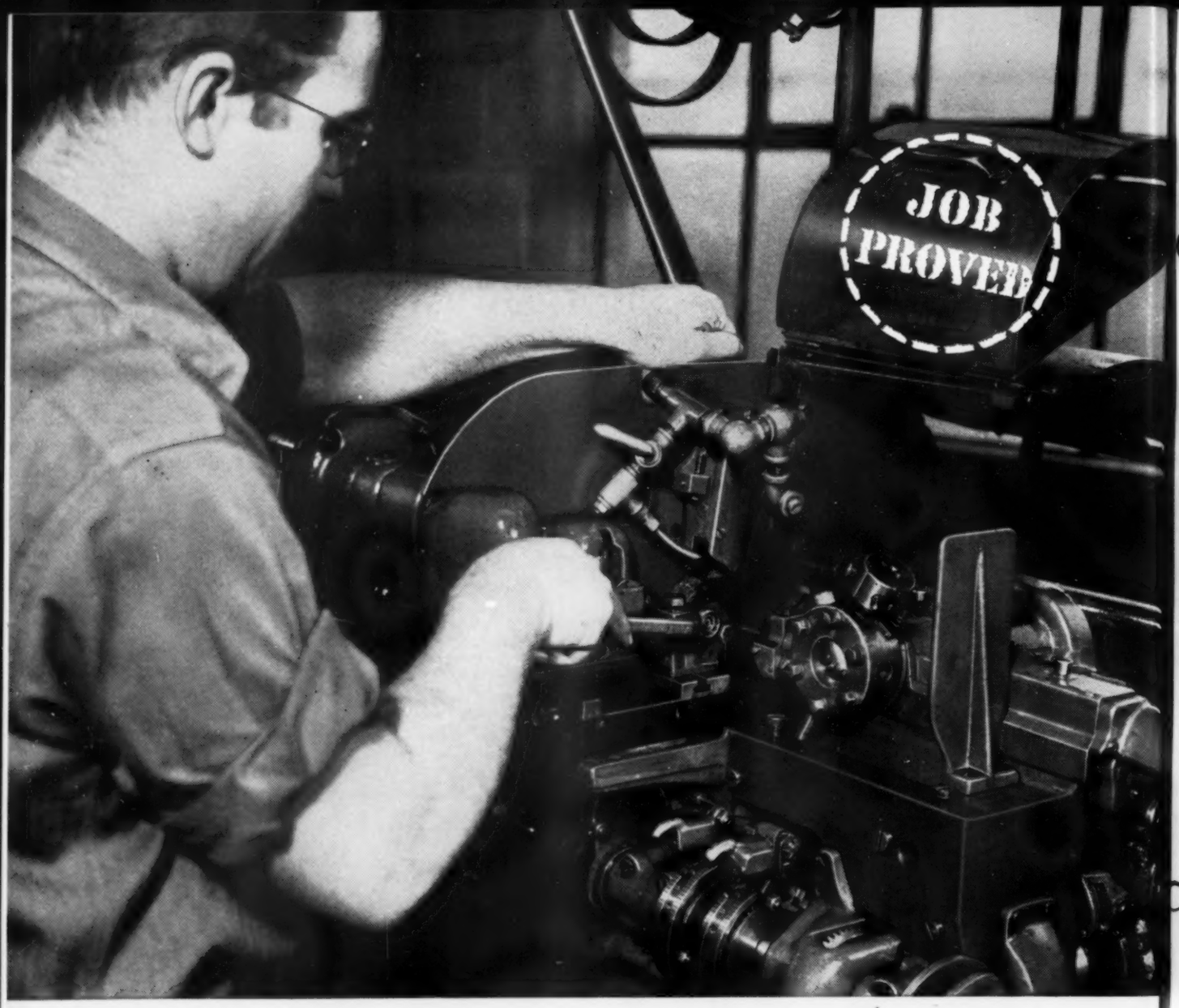


Light steel parts can often be supported from permanent magnet tips on spreader arms. Sometimes the hanger hooks support the parts, the magnets keep the parts from swaying while in the spray zone





Double-hook hangers work well for work of irregular shape



TOOL LIFE TRIPLED

Sunicut with Petrofac* Improves Finishes and Lengthens Tool Life in Intricate Machining Job

In the machining of small parts for radios, a shop was using a dark cutting oil with poor results. Finishes were rough, tool life was unsatisfactory. The dark oil made the work hard to see.

Changing to Sunicut with Petrofac, the plant found the ideal oil for its purpose. Its cooling and lubricating qualities are producing excellent finishes, and increasing tool life from 10 hours to 30 hours. Further, machinists can see the work better through this transparent oil.

Job: Turning, forming, threading, pointing
Machine: Brown & Sharpe OOG Automatic
Part: Stud pulley for radio
Material: B 1112 steel
Tools: Rex AA high-speed circular form tools
Spindle Speed: 2,600 R.P.M.
Cutting Speed: 165 S.F.P.M.

These new grades of Sunicut with Petrofac are making possible better finishes than ever, and faster work in a wide range of operations. The new Sunicut grades with Petrofac possess superior metal-wetting, anti-weld, and extreme-pressure qualities. They are not blended with animal or vegetable fatty oils—cannot turn rancid. For additional information about the various Sunicut cutting oils, write for folder AM-8.

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In Canada: Sun Oil Company, Ltd.
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SUN PETROLEUM PRODUCTS
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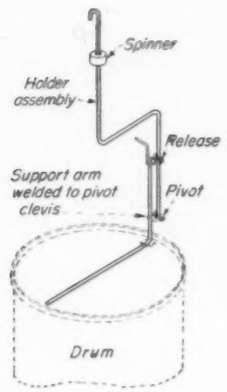
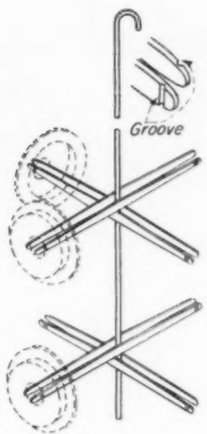
American Machinist

REFERENCE BOOK SHEET

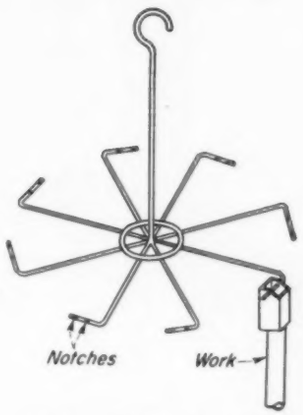
Hangers for Electrostatic Painting — II



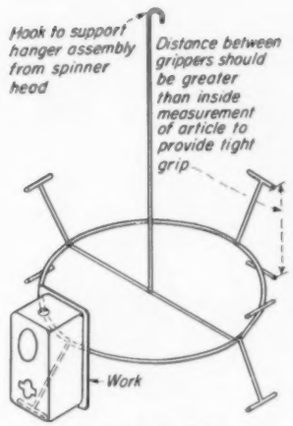
Hanger for supporting closed steel drums with hole in one side of top. Support arm enters this hole and then is turned to vertical for locking



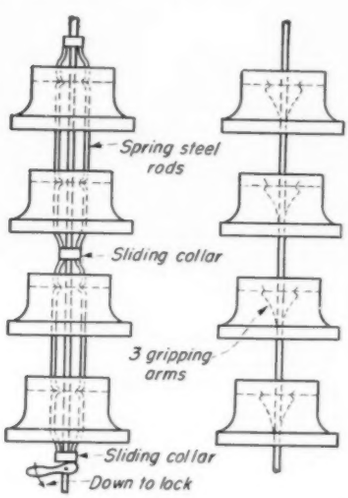
Spreader arms are grooved for snap fastening of lamp reflectors



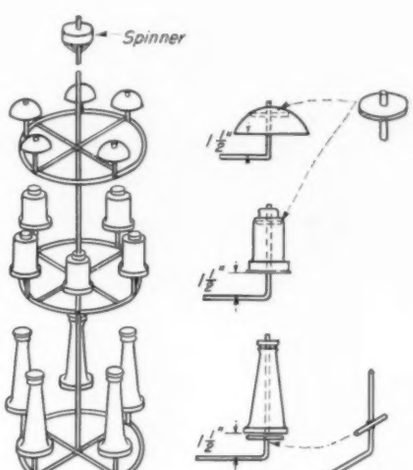
Eight relatively long parts are held by this hook-type hanger. Rotation of hanger in spray booth insures equal coating on each part


Hook to support hanger assembly from spinner head
Distance between grippers should be greater than inside measurement of article to provide tight grip
Work
Four Parts to Tier

Four spring grippers are spaced around the tier ring to hold drawn-steel boxes

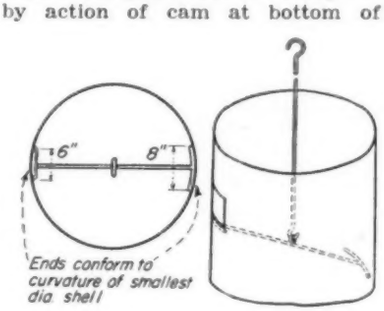


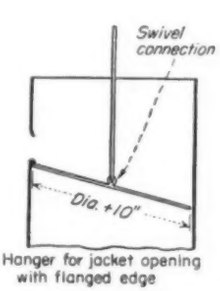
Two different hangers for supporting lighting fixture parts are sketched above. Holder at left has three spring-steel rods which are expanded against bore of flange inside part by action of cam at bottom of hanger

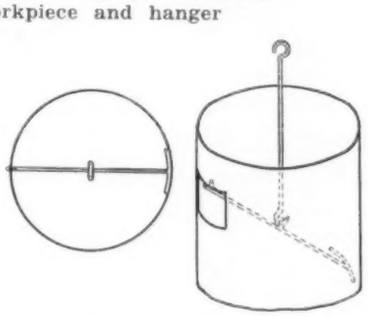


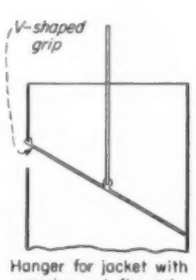
Different lamp parts are supported on each of the three tiers of this rotating hanger. Crosspieces on each vertical support rod insure proper clearance between workpiece and hanger

Sometimes simple "S" hooks can be used economically for supporting parts









These simple hangers hold water-heater shells. Left—Workpiece has flanged edge around opening in wall, and cross arm fits against this flange to help support part. Right—The opening is not flanged and cross arm has notch in end to catch against upper edge of opening. In each case, cross arm must be longer than shell diameter

the grinding job

Surface grinding circular mold plate SAE 1050 steel on a No. 18 Blanchard Surface Grinder. This is a second machining operation, removing ⅛" stock. Eliminates subsequent boring mill operation. Requires good commercial finish with no burn.

the wheel

N Borolon vitrified bonded abrasive segments, NA241-H7-V2 mounted in 18" Blanchard chuck . . . standard for this operation because of good wheel life combined with heavy stock removal. This application is typical of the successful use of Simonds Abrasive Segments, available in all sizes and shapes to fit all standard chucks.

SEGMENT STYLE "BL"

Borolon ALUMINUM OXIDE — *Electrolon* SILICON CARBIDE

SIMONDS ABRASIVE CO.

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Grinding Wheels

Every size and shape for every grinding job . . . centerless, crankshaft, cut-off, cylindrical, internal, knife grinding, mounted points, portables, roll grinding, saw gumming, snagging, surfacing (wheels and segments), tool and cutter, bricks, sticks, stones and abrasive grain for polishing, pressure blasting, anti-slip, etc.

where to get it

Simonds Abrasive Distributors in all principal industrial centers of the U.S. and in many foreign countries carry stocks and can advise on grinding wheel selection. Write today for Technical Manual on Modern Surface Grinding Practice. Also for name of nearest distributor.

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Quality control has characterized Simonds Abrasive Company products during more than 50 years as a major manufacturer of grinding wheels and abrasive products exclusively. This control begins with the abrasive grain produced in modern electric furnaces by Simonds Canada Abrasive Co., Ltd., and extends to the finished wheels for all types of grinding from roughing to precision finishing. This means consistently high wheel performance—long lasting action, that boosts production, cuts grinding costs.

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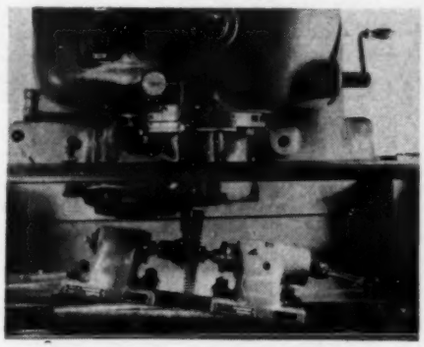
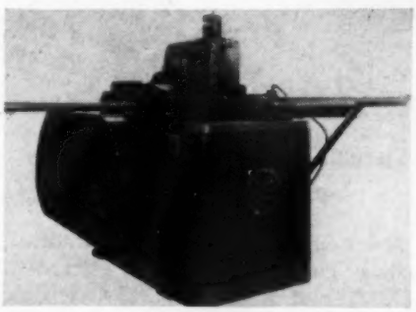
Shop Equipment News



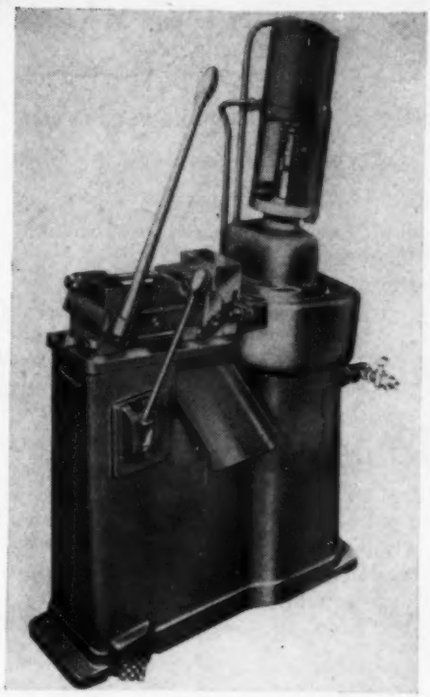
Close-Shoulder Gears Shaved With Red Ring Involute Cutter

A conical, involute cutter has been developed by National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich., for close-shoulder gear shaving. Developed by Red Ring engineers, the cutter is designed to overcome the difficulty of restricted cutting action because of the small angle between the axes of the cutter and work gear. The work is now tipped away from the cutter allowing sufficient angle between the axes of the cutter and work gear. This method of shaving is applicable to spur and helical gears or teeth which are tapered away from or toward the shoulder gear.



Tube Cutoff Machine by Grieder Operates Manually, Automatically

Grieder Machine Tool & Die Co., 324 N. Maple St., Bowling Green, Ohio, offers a cutoff machine that cuts any diameter or wall thickness of tubing within the range of the machine in less than 1/3 sec. per cut. The cycle of the machine is 12,000 cuts per hr. The cutting time for various sizes, shapes, and wall thickness is the same. Interchangeable dies allow change over from one diameter size to another. Automatic or manual operation is possible. The machine will cut various shapes of tubing such as round, square, rectangular, hexagon, octagon, open, and lock seam.



DCMT Small Die-Casting Machine Can Maintain 20,000 Shots per wk.

A small die-casting machine is marketed by DCMT Sales Corp., 315 Broadway, New York, N. Y. Listed as model M55A/HF, the machine is air-operated and designed for economical casting of small parts in zinc alloy, utilizing single-cavity dies operating at high speed. It can maintain a production rate of 20,000 shots per week. Optional hand and foot controls and an air system with pilot and ram valves are included. The base plate is adjustable to allow the use of die blocks of any required thickness.

The pot uses hydraulic suction to fill the cylinder. A porthole at the base of the pot allows the metal to be used before refilling is necessary. The machine is priced at $1650, list.

Improved Flexible-Shaft Machine Offers Redesigned Countershaft

An improved flexible-shaft machine is offered by Elliott Mfg. Co., Binghamton, N. Y., featuring a countershaft mounting spaced well above the motor-tilt axis to give endwise yielding motion to the flexible shaft as the motor assembly is tilted.

The countershaft includes a vertical adjustment operating on a lead-screw principle, with finger-tip knob control. The vertical adjustment is operative through over 4 in. to provide belt tensioning. By substituting an optional variable-pitch pulley for the cone-pulley on the motor shaft, the vertical adjustment provides stepless-speed variation through a ratio of over 2:1. An improved hinged guard with shock mounting swings away from the drive pulley at the press of a button, exposing the parts, as when changing belts.

Swing-Frame Cutoff Machine Gives 180° Maneuverability

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa., introduces the Fox swing-frame cutoff machine designed for the flexible-type cutoff wheels. Machine removes sprues and risers from bronze, aluminum, and iron castings. Having maneuverability through 180°, the cutoff machine No. 10-C is powered by a 7½-hp. enclosed fan-cooled motor. It accommodates wheels 16x5/32x1 in. wide. Clearance has been provided at the grinding face of the stand grinders to accommodate a wide variety of casting shapes. The wheels operate at a peripheral speed of 15,500 feet per minute.

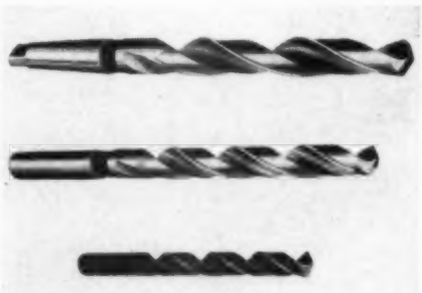
Circuit-Breaker Panelboard Identifies Branch Circuits

A circuit breaker plug-in panelboard is offered by the Square D Co., 6060 Rivard St., Detroit 11, Mich., incorporating a system of branch-circuit terminal marking. The 3-phase 4-wire arrangement of the NMO panelboard eliminates doubt as to phase identification of branch circuits by including letters A, B, and C opposite each branch-circuit load terminal connected to the corresponding three phases. Further identification is obtained by use of a marking strip with black background for phase A, red for phase B, and blue for phase C. The connection diagram furnished with each panelboard is printed in corresponding color.

A split-bus arrangement provides distributed phasing of A and B circuits and group phasing of C circuits. Two-pole 208-v. circuits can be obtained in addition to the usual single- or two-pole 120-v. circuits, by connecting to adjacent A and B terminals. Breaker units are the high-speed thermal-magnetic trip type, providing 2-way circuit protection.

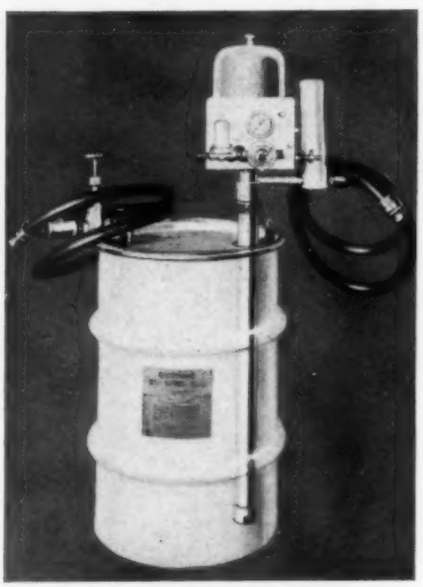
Niagara Gap-Frame Power Presses Offered in The Double-Crank Type

A line of welded-steel gap-frame double-crank presses is offered by The Niagara Machine & Tool Works, Buffalo, N. Y. The short strokes, rigid box crown, and deep bed make it suitable for use with fine blanking dies and for forming work requiring heavy load at the bottom of the stroke. Long or irregular sheets and strips can be fed either from front to back or right to left. The presses are built in seven sizes ranging in capacity from 44 to 244 tons and the machines in each size are made in five to six widths to handle work requiring a wide range of capacity and bed area.



TAPERED SHANKS have been added to their standard line of carbide-tipped twist drills by Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. Tapered shanks are available in the same sizes as straight shanks, from ⅛ to 1 in.

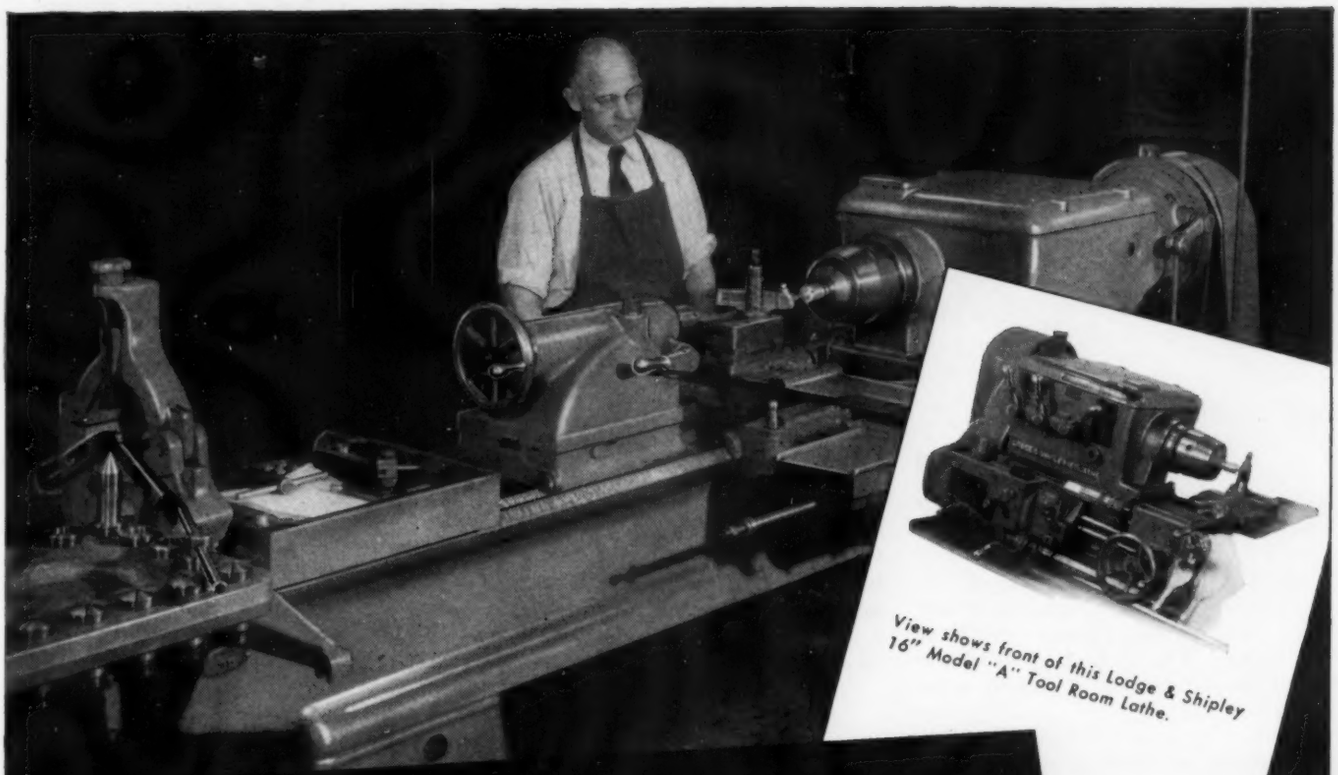
FLOOR MACHINES offer the control handle in proper relation to the revolving brush to counterbalance starting and running torque so that the machines have better control. Made by Breuer Electric Mfg., 5100 Ravenswood Ave., Chicago 40, Ill., the Tornado floor machine is offered in five models with brush spreads ranging from 12 to 20 in. Noise is said to be reduced to a minimum.



Siefen's Circulating Pump For Multiple Spray-Gun Jobs

A circulating pump for multiple spray-gun installations is offered by J. J. Siefen Co., 5631 Lauderdale, Detroit 9, Mich. The pump provides liquid buffing and polishing compounds to revolving wheels at the proper pressure for each gun. Air at line pressure is regulated at the pressure regulator on the pump to give the required pressure of the fluid. The pump will deliver 5 gpm., permitting an unlimited number of guns to be supplied from one pump.

Noted air conditioning manufacturer checks 3 year record of Lodge & Shipley lathes



View shows front of this Lodge & Shipley 16" Model "A" Tool Room Lathe.

"IN FIRST CLASS CONDITION... DOING AN EXCELLENT JOB" SAYS CARRIER CORP.

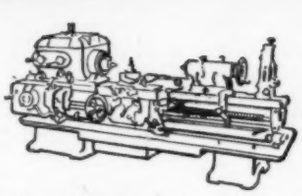
Carrier

"Lodge & Shipley Lathes cut time 40%" according to the records of the Carrier Corporation. And, after three years service in the plant of this noted air conditioning and refrigeration manufacturer, Lodge & Shipley Lathes "are in first class condition... doing an excellent job."

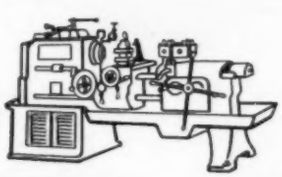
In the illustration above, a Lodge & Shipley Model "A" 16" Tool Room Lathe is turning a die part in the Carrier Syracuse, N. Y. plant. This lathe, used on the production of jigs, fixtures, dies and miscellaneous tools is rugged enough for the toughest possible range of work . . . yet accurate and dependable.

Specifically designed to cut time and cost . . . Lodge & Shipley Tool Room Lathes offer fifty-five instantly selected feeds . . . ranging from fine feeds to coarse hogging cuts.

You too, will find Lodge & Shipley Lathes ideal for a wide variety of superior lathe work in record time. See your nearby Lodge & Shipley representative for details of how Lodge & Shipley Lathes can save you hours and dollars. Write for condensed Catalog showing the complete line.



Lodge & Shipley Engine, Toolmaker, Manufacturing, Hollow Spindle and Gap Lathes.



Lodge & Shipley Acme Turret Lathes in Way-type, Ram-type and Saddle-type Models.

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
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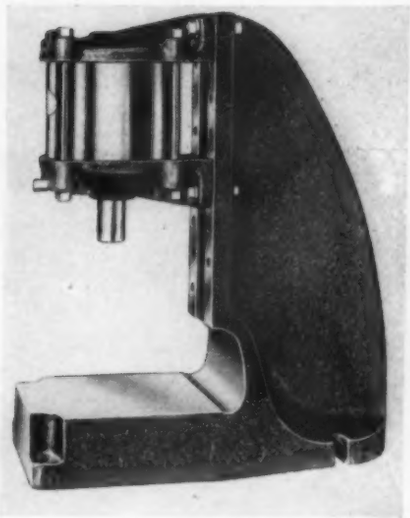
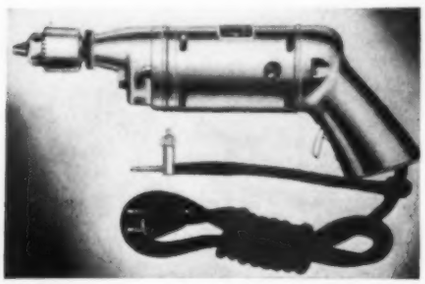


Bellows BAP-20 Arbor Press For Light, Medium Pressing

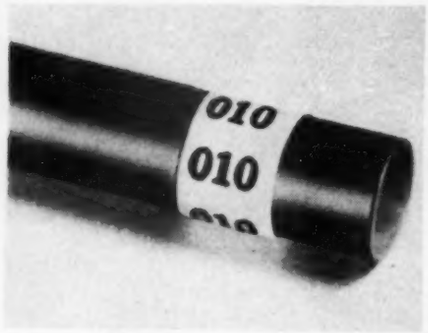
A Controlled-Air-Power arbor press has been announced by The Bellows Co., Akron, Ohio. Called the Model BAP-20, the press is suitable for light to medium pressing operations such as forming, flaring, stamping, crimping, riveting, and other operations as well as light broaching operations.

The arbor press is powered by a special 5½-in. bore Bellows air cylinder, developing a thrust of approximately 20 times the operating air-line pressure. It can be used on any line pressure ranging from 5 to 175 psi. The cylinder has a built-in speed-control valve which permits infinite variation in the speed of the advance stroke. Stroke length is adjustable from a fraction of an inch up to 2½ in. max. Maximum clearance of the 1¼-in. dia. ram shaft is 7 in.

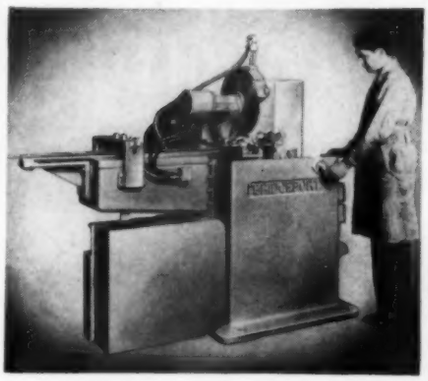


Portable-Type Electric Drill Employs Pistol-Grip Handle

A ¼-in. portable electric drill, Model 250, is offered by Portable Electric Tools, Inc., 255-259 West 79th St., Chicago 20, Ill. A pistol-grip handle with a Cutler-Hammer trigger switch is included. It is air-cooled and of the universal type ac.-dc., 110-115 v. The drill is supplied with a 6-ft. rubber-covered cable and attachment plug. The no-load speed is 1400 rpm.; the full-load speed is 600 rpm. Capacity in steel is ¼ in.



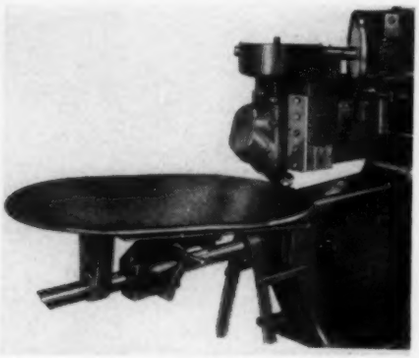
MARKERS, the E-Z code wire markers, are offered by Western Lithograph Co., 600 East Second St., Los Angeles, Calif. Markers are used to identify raw metals and are tough adhesive strips that adhere to any metal surface and are unaffected by temperature, humidiy, and handling. Markers provide an infinite number of codes, and will not rip, tear, pull, or slip off, but can be easily peeled off



Automatic Abrasive Cutoff Machine Will Cut Stock to 12 in. in Length

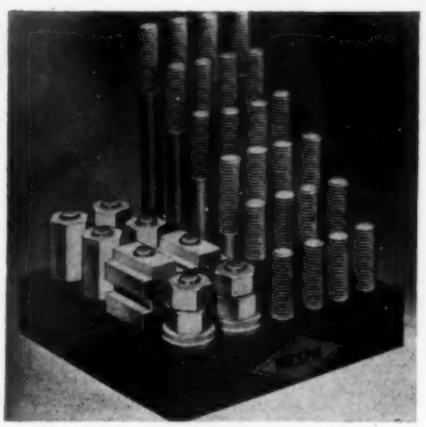
An automatic abrasive cutoff machine for high-speed cutting of stock up to 2 in. square to lengths ranging from ¼ to 12 in., is offered by The Bridgeport Safety Emery Wheel Co., Stratford, Conn. Steel, brass, plastics, porcelain, and other materials can be cut. Listed as model No. 51, the machine has a head assembly which consists of an 18-in. abrasive cutoff wheel driven through V-belts by a 10 hp. motor.

The head is mounted on a rocker shaft actuated by a hydraulic cylinder which feeds the wheel in and out of the cut. The hydraulically operated feed mechanism is synchronized with the cutting head and automatically feeds a predetermined length of stock into position where it is gripped by a holding vise. After the cut is completed the wheel withdraws, the feeder returns to normal position, and the cycle is repeated automatically until the stock is exhausted or the machine is stopped by the operator.



Automatic Machine by Kling Shears, Flanges, Forms Sheets

An automatic shear, flanger, and former, using rotary or circle shears is offered by Kling Bros. Engineering Works, 1320 N. Kostner Ave., Chicago 51, Ill. The machine will shear, flange, and form sheets or plates in many odd and irregular shapes, and eliminates hand-guiding methods. Once the sheet or plate has been placed in position, the operation is guided automatically.



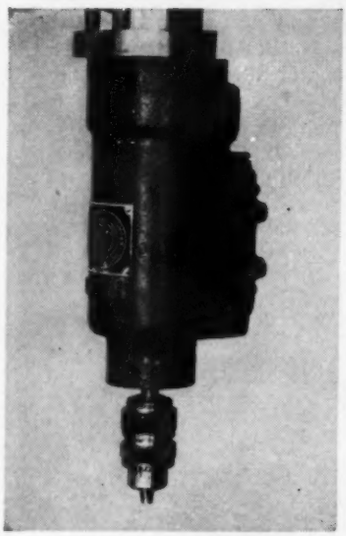
STUD AND NUT SET is offered by West Point Mfg. Co., 19637 Merriman Court, Farmington, Mich. Sets are available in ¾-, ⅝-, and ½-in. standard thread sizes in class 3 fit. Each set includes four each of 3-, 4-, 5-, 6-, 7-, and 8-in. studs, four each of the nuts, washers, T-slot nuts and coupling nuts. Coupling nuts enable operator to obtain stud lengths from 3 to 16 in.

ATTACHMENTS FOR LELAND-GIFFORD DRILLS

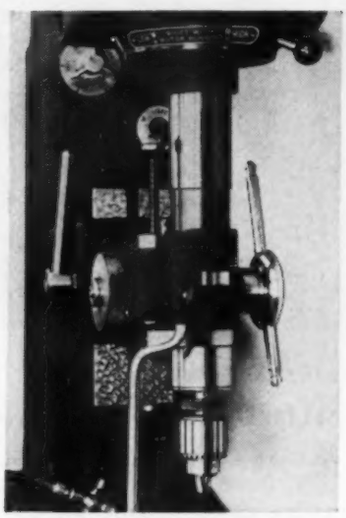
Are you getting the most from your Leland-Gifford drilling machines?

Perhaps some of the Leland-Gifford attachments shown here would help you.

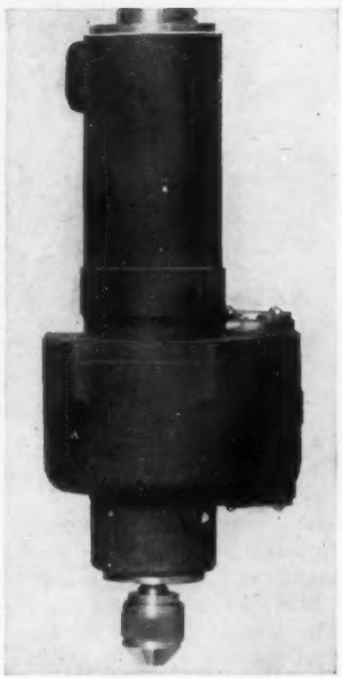
A post card will bring one of our sales engineers to explain them.



FRICTION TAPPER
FOR NO. 1 LMS DRILL

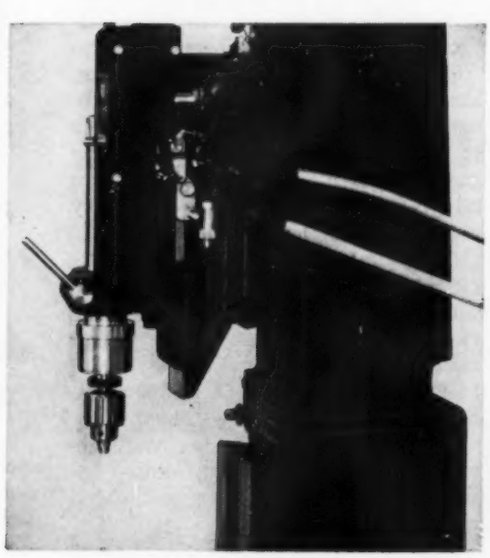


NO. 1 LMS SPEEDER
—SPEEDS 3000 TO 9000

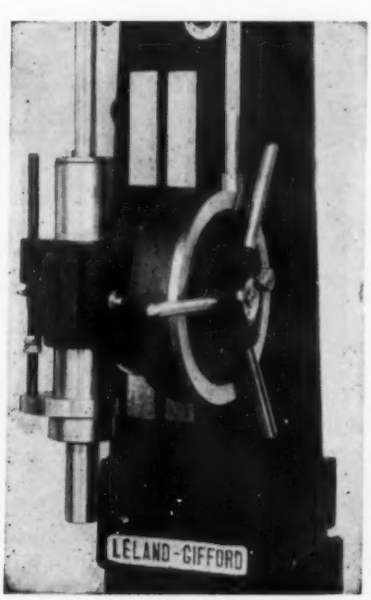


FRICTION TAPPER
FOR NO. 2 LMS DRILL

BACK GEAR FOR
NO. 2 & NO. 3 MACHINES



HYDRAULIC FEED FOR
NO. 1, NO. 2 & NO. 3 MACHINES



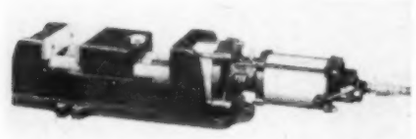
SEMI-AUTOMATIC
POWER FEED FOR NO. 2
LMS DRILLING MACHINE

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

Pneumatic-Tired Ford Truck Offered in 6000-lb. Capacity

The Yardlift No. 60 pneumatic-tired fork truck is offered by Clark Equipment Co., Industrial Truck Div., 258 Champion St., Battle Creek, Mich. The truck offers a 6000-lb. capacity. Standard lift is 112 in., with an overall height of 85 in. Machines are designed for outdoor handling operations and for smooth movement of unit loads over rough, uneven, slippery surfaces.

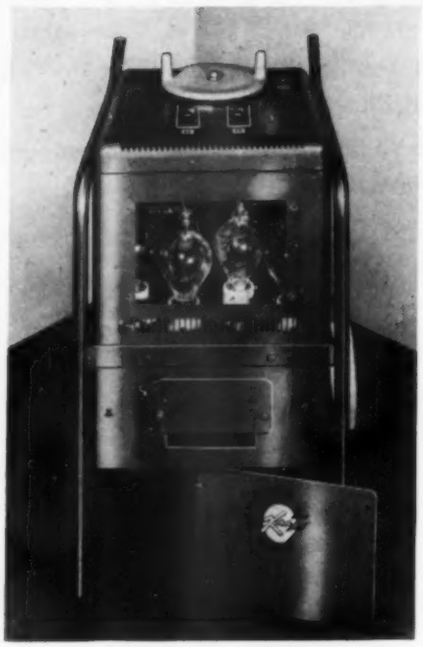


Clamping on Air-Hydraulic Vise Done with Controlled Air Pressure

The Model DVH-150 air-hydraulic vise is offered by The Bellows Co., Akron, Ohio, using flexible, controlled air pressure as a clamping force. The vise develops a clamping pressure of 150 times the operating air-line pressure from any air-line pressure up to a maximum of 125 lb.

Opening of the jaws is adjustable from a fraction of an inch to 5 in. in increments of 1/32 in., through a positive-locking adjusting nut on the hydraulic ram. Power is obtained from a Model BM-10 air motor in combination with a special built-in hydraulic-intensifier unit.

The vise is available with either a mechanically operated valve for hand operation or for mechanical synchronization to machine movement; or with the Bellows low-voltage solenoid valve for electrical operation. Over-all size is 30 3/16x 9x6⅛ in. The 6-in. wide jaws are 1⅝ in. high.



Dc.-Ac. Arc Welders by Kern Set for Operation by Switches

John A. Kern Co., 224 N. Loomis St., Chicago 7, Ill., offers the DuelTronic combination dc.-ac. welder for both dc. and ac. arc welding. The arc is set for dc. or ac. operation by two switches and a lever. For dc. operation the machine uses rugged rectifier tubes in a flexible mounting to supply the current. The instant arc action is said to be due to the absence of moving parts, which makes it unnecessary to overcome inertia or to neutralize armature-reaction effects. Straight- or reversed-polarity electrodes can be used.

The combination dc.-ac. welder is offered in two models, No. 20 DA, and Model 25 DA. The former has a dc. range of 5 to 60 amp., and an ac. range of 25 to 200 amp. The Model 25 DA has a dc. range of 5 to 90 amp., and an ac. range of 25 to 200 amp.

The stable arc, combined with accurate amperage control, allows application requiring inert gas-shielded arc welding.

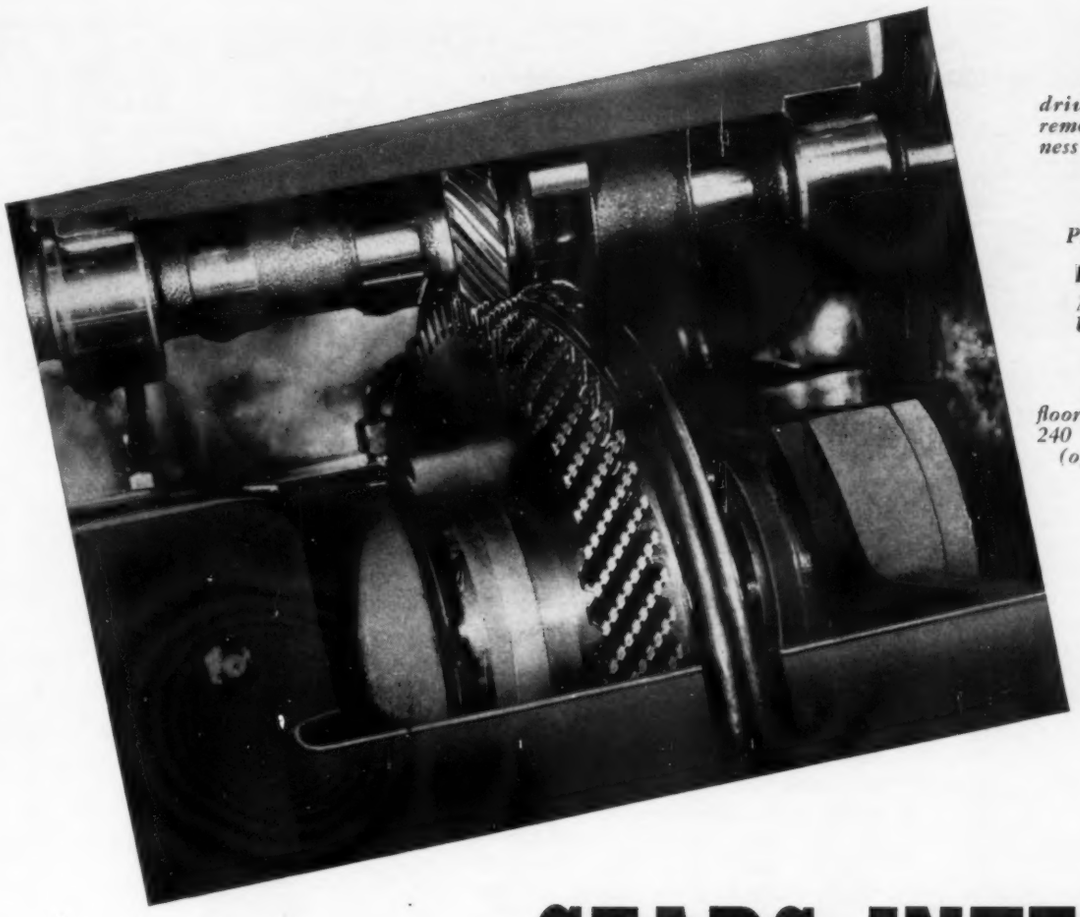
GRANITE STRAIGHT EDGE is offered by Herman Stone Co., 324 Harries Bldg., Dayton, Ohio. Straight edge is said to be made to an accuracy of 0.0001 in. every 3 ft. Continual rechecking is not necessary because of the non-warping qualities. Sizes are available to 6 ft.

Carpenter's Color Program Identifies Tool, Die Steels

The Carpenter Steel Co., Reading, Pa., announces a color program to simplify tool-steel identification. Bars of matched tool and die steels are now painted full length. A wall chart will be a further aid to selection and identification. Different grades are being painted varied distinctive colors. Twelve different colors identify steels in the air-hardening, oil-hardening, water-hardening, and red-hard matched sets.

Ridermikrokator by Swedish Gage Checks Centerless-Ground Pieces

The Ridermikrokator intended for checking out-of-roundness and diameters of cylindrical parts is marketed by Swedish Gage Co. of America, 8900 Alpine, Detroit 4, Mich. Measurements are carried out according to the three-point principle. The instrument can be used for checking centerless-ground pieces. Frames are made of malleable cast iron. The measuring instrument is a standard mikrokator No. 220 which is locked in the frames by a screw. This instrument is supplied with a removable measuring point No. 524, sizes 1 and 2. Frames are provided with hardened, ground, and lapped anvils and insulating grips. The angle between the anvils is 60°.



THE JOB:
Finishing distributor drive gear. .004" to be removed on chordal thickness at ends, and .002" near center of teeth.

TOLERANCES:
Plus or minus .0005".

MACHINES USED:
Michigan Rotary Underpass Finishers.

PRODUCTION:
45 seconds per gear, floor to floor, per machine. 240 gears per man hour (operating 3 machines).

GEARS INTEGRAL WITH SHAFTS:

Finish them faster and more accurately on a Michigan Underpass

For instance, those distributor shaft drive gears on camshafts. There is no reason why you cannot make them just as quiet just as quickly as other gears shaved on Michigan gear finishers.

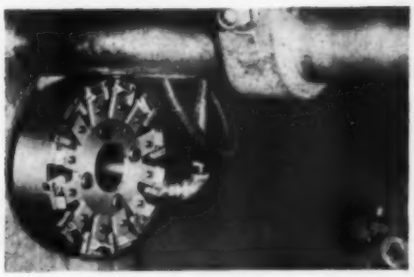
One company is finishing such camshaft gears in less than 45 seconds each . . . floor to floor . . . *and that's fast!* What's more, the machines are so easily operated that one man can run three of them, if you should need that much production. Or, he can run a Shear-Speed, cutting another gear, in addition to the "870" underpass shaver.

About the only difference between a camshaft gear shaving machine and a standard "870" is a somewhat longer headslide to accommodate the longer shaft, plus a couple of steady rests to support the camshaft at the bearings close to the gear being finished.

For complete information ask for Bulletin 870F

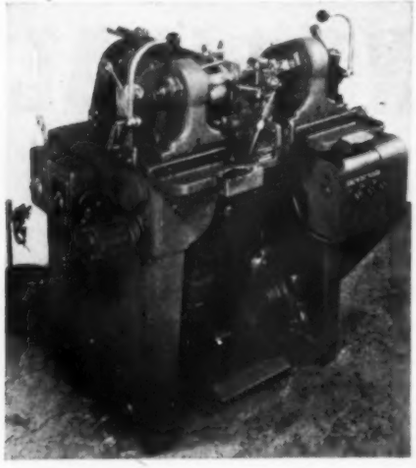
ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.



Diamond-Detroit Milling Cutter Employs Solid-Carbide Inserts

A milling cutter has been developed by Diamond-Detroit, Inc,, Detroit 2, Mich. Used for face milling, the cutter embodies solid triangular-carbide inserts which can be adjusted or substituted in the cutter head while the latter is in milling position. When a blade becomes dull, it is turned to the next triangular cutting edge. After the three edges on one end of the tool are used, the tool is reversed and the process repeated, effecting a total of six single-point cutting tools.



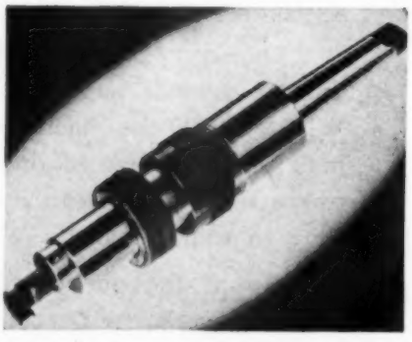
Automatic Armature Winder Features Cam-Cycle Control

An automatic armature winder is marketed by The Globe Tool & Engineering Co., 436 Davis Ave., Dayton 3, Ohio. The armature core after being placed into the loading bracket, is untouched by the operator until removed as a completely wound armature. The machine automatically controlled from its cam-cycle control, chucks the armature under power, starts the wire continuing from a previous armature, pulling anchored commutator leads, winding, indexing, and finally stopping automatically when the armature is wound. Winder incorporates rotating fliers, working in opposite directions, for winding of opposite coils simultaneously in armatures having an even number of slots.

Load-Mobile by Market Forge Is an Electric Lift Truck

Market Forge Co., 25 Garvey St., Everett 49, Mass., introduces a rider-controlled electric lift truck called the Load-Mobile. A folding step is provided for the operator for use when he continually must be on and off the truck. A swivel seat allows him to face away from the load when desired. Two speeds are furnished, controlled by a pedal. The instant the operator removes his foot from the pedal the brake goes on.

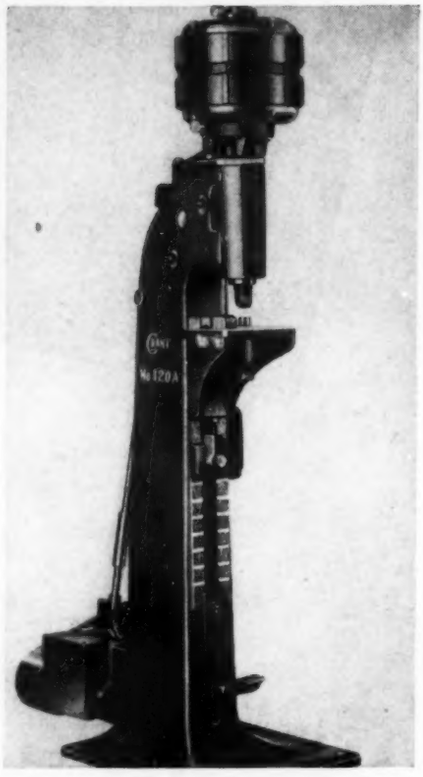
The truck is available in two models: No. 3000, and No. 5000, both with 20% guaranteed-over-load capacity. The speed of the former will average approximately 3.5 mph., the latter, 3.0 mph. The truck comes in lengths from 36- to 72-in. length of platform. A full lift of 4 in. will be available on all models.



Recessing Tools by Maxwell Work Through Jigs, Fixtures

A jig-and-fixture type recessing tool for precision recessing where the tool must work through jigs and fixtures, is offered by The Maxwell Co., 386 Broadway, Bedford, Ohio, in three sizes to machine diameters ranging from ½ to 2 3/16 in. The tools pilot into standard bushings and operate on any manual- or automatic-feed spindle. The distance from the face of the work to the recess is controlled by adjusting the ball-bearing stop bushing.

By releasing the combination positive lock and friction clamp, cutters can be interchanged, giving the tool wide range of application. Various types of cutters can be used including radius, multiple-groove, and others. Tool shanks are also interchangeable.



Noiseless Rivet-Spinning Machine Employs Automatic-Trip Mechanism

An automatic-trip mechanism for use on three of the company's noiseless rivet spinning machines is offered by Grant Mfg. and Machine Co., 85 Silliman Ave., Bridgeport 5, Conn. The automatic trip enables the operator to form heads on rivet shanks in from one to two seconds, depending on the rivet diameter.

The trip mechanism is powered by a ¾-hp. motor, and the spindle motion for proper riveting performance is automatically achieved by means of a cam. Depressing the treadle actuates the trip for one cycle, or, the heading of one rivet. Maximum capacity of these machines is 7/16-in. dia., and the total weight is about 800 lb. Operator can remain seated while running machine if desired.

Carbide plugs for production "leaks"

Recently a Carboloy engineer was called into a plant to help eliminate a known "leak" in production efficiency.

Chips were piling up in a boring machine, finishes were torn, tools wore "like sixty" . . . carbide tools, at that!

The Carboloy engineer investigated, figured, came up with a startlingly simple answer: *He recommended double the work speed,* and a slight change in tool design.

Result? Nearly doubled output, cleaner finish, much longer tool life, and a switch from special tools to lower priced standard Carboloy tools, too!

Call for Carboloy "Know-How"

In your constant effort to obtain peak efficiency, back up the intimate knowledge of your own production men with the specialized "know-how" of Carboloy engineers. Carbides are their business. They bring to your plant a broad experience in obtaining maximum results with carbides.

Often, slight changes in tool design, speeds or feeds, grinding, or tool handling effect far reaching economies and increases in out-put.

Together, your engineers and our Carboloy specialists can form a team nothing can stop. Together they can use carbides to plug up many drains on your plant's productivity.

Ask for your Carboloy engineer

Call in your Carboloy engineer. He'll be glad to help with your carbide application problems, or in the selection of the most economical tooling from any of Carboloy's 600 standard tools and blanks, or special Carboloy-tipped tools made by more than 150 tool manufacturers.

Why not call your Carboloy engineer? Or write us direct: Carboloy Company, Inc., 11149 E. 8 Mile Street, Detroit 32, Michigan.

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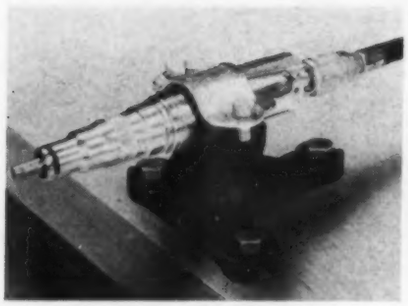
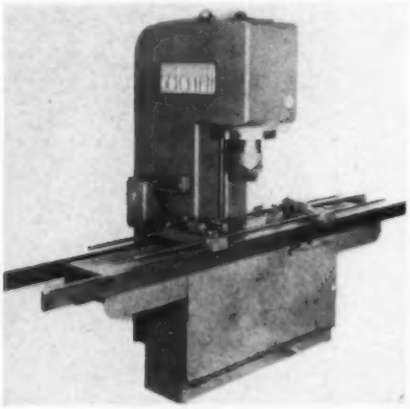
Standards stocked by authorized distributors in 82 cities coast to coast.

CARBOLOY®
CEMENTED CARBIDE



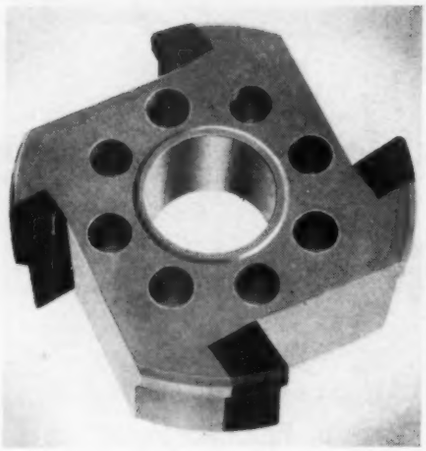
Aro Tool-Mounting Fixture Adjustable to Any Position

The Model 7101 tool-mounting fixture is offered by Aro Equipment Corp., Bryan, Ohio for all types of portable tools. The fixture is adaptable to many screw-driving and nut-setting jobs where it is practical to bring the assembly to the tool. Mounting fixture is adjustable to any position, and will accommodate Aro air tools from the small size drills, grinders, and other tools, to the large ½-in. drill. It is also suited for all electric tools. The clamp for holding tools is designed to accommodate various diameters.



75-Ton Straightening Press Handles Rough, Finished Work

A 75-ton hydraulic straightening press has been announced by Colonial Broach Co., P. O. Box 37, Harper Station, Detroit, Mich. Designed for handling both finished and rough work, the machine employs a double-rail straightening fixture to take care of the larger and heavier work. Rams are direct-acting from high-capacity hydraulic cylinders mounted in the head, and are available with bronze ram noses in place of the standard steel design, if desired. Floor space is 54x140 in., including the straightening fixture. Stroke of the ram is 12 in., with a power-stroke speed of 45 ipm., and a return speed of twice this amount.



Circular Carbide-Tipped Tool Performs Turning, Chamfering

A carbide-tipped tool has been added to the standard line of circular carbide-tipped cutting tools manufactured by R. F. Cook Mfg. Co., 2732 Second St., Cuyahoga Falls, 3, Ohio, which is capable of performing turning and single-chamfering operations. The tool incorporates four individual cutting edges, and can be used on any type of automatic. It can be used for high-speed long production jobs or for limited-piece operations. Carboloy cemented-carbide tips are used.

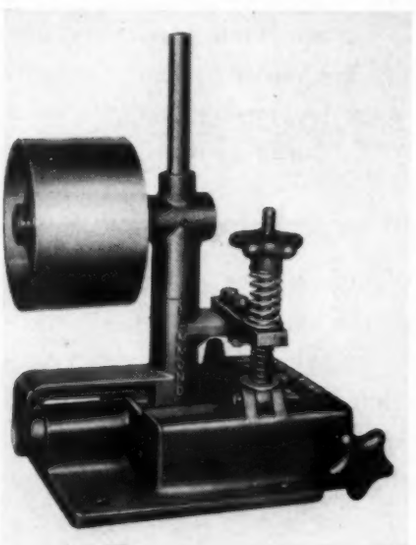
Carbide Micro-Center Reamers Finish Centers After Hardening

A carbide tool for the finishing of centers after heat treatment is offered by Severance Tool Industries Inc., 726 Iowa St., Saginaw, Mich. The burnished-like finish desired when hardened materials are turned or milled with carbide tools is said to be possible in the centers of parts having hardness up to 63-C Rockwell with these reamers. Cutting teeth are said to avoid chatter and to correct existing irregularities. They can also be used for shifting centers to correct misalignment.

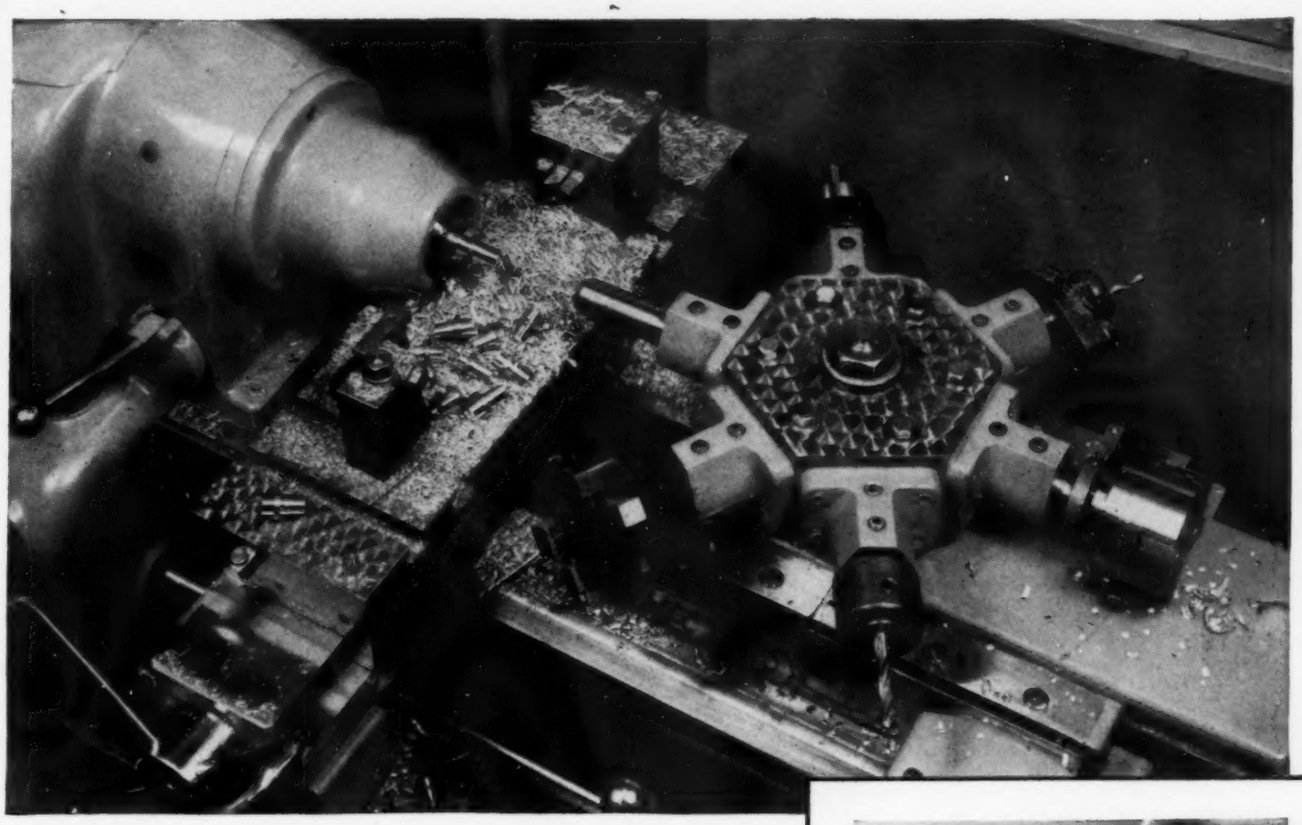
Micro-center reamers replace abrasive center polishing and center lapping and can be used in standard center-lapping machines, or drill-presses. They have the standard 60° included angle and are available in ⅜- and ½-in. dia.

Sperry Supersonic Reflectoscope Makes Non-Destructive Type Tests

The type SR05 supersonic reflectoscope is offered by Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J., for non-destructive testing of metals and other materials for internal defects, and for testing welds. The redesigned circuits decrease weight and bulk of the model, which is approximately 14x16x23 in. Overall weight now is approximately 85 lb. The number of external controls has been reduced to five. With these controls operator varies sensitivity, pulse width, sweep length, screen markers, and frequency.



BENCH BACKSTAND, model 6-B, is offered by Hammond Machinery Builders, 1600 Douglas Ave., Kalamazoo, Mich. Model 6-B has an 8-in. diameter by 4½-in. face dynamically balanced aluminum pulley for up to 4 in. wide abrasive belts. The heavy cast-iron base is drilled for mounting



THE MONARCH SPEEDI-MATIC . . .

pays for itself in 2 years

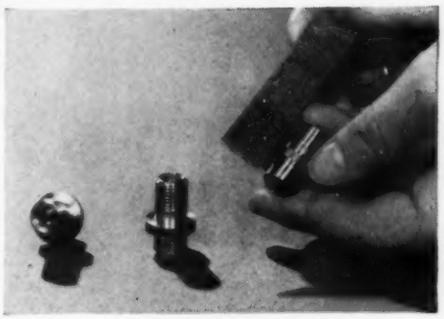
on jobs like this

That's the record of the "*World's Fastest Hand Screw Machine*".

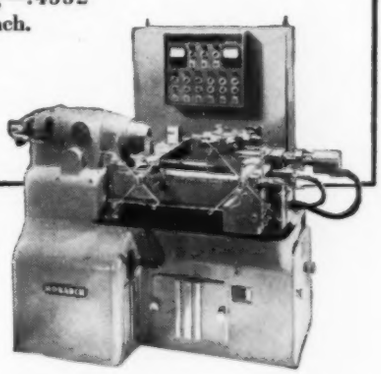
One customer, in fact, has already saved over half the price of his two Speedi-Matics in just nine months of operation—an annual return of 66⅔% on his investment.

Saving possibilities of the Speedi-Matic are completely realized on jobs such as the one illustrated. Extra close tolerances are held, consistently. The variety of cuts takes full advantage of the automatic electronic speed and feed change. With a spindle speed range of up to 5000 rpm maximum, very small work, the softer metals and carbide cutting tools are accommodated at top efficiency.

For "*peak production at a profit*" on jobs up to ⅞" bar stock size—and in lots as small as 25 or up to 500 and more—you can't beat the Speedi-Matic. Ask us for documented case-history proofs of this statement, illustrated in bulletin 1902.



JOB FACTS: Brass adapter plug completely machined in one setup, on the Monarch Speedi-Matic, using all six turret faces, front and rear cross slides, and eight control panel stations. Spindle speeds employed include a low of 800 rpm and a high of 3800 rpm. Total time, including handling—.4332 minutes each.



ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

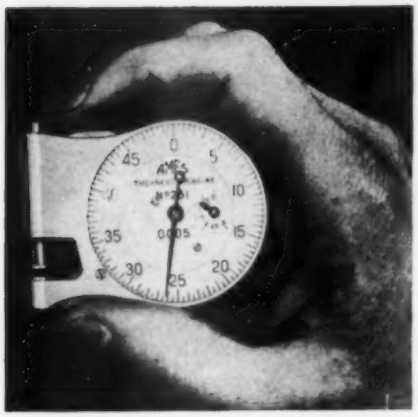
THE MONARCH MACHINE TOOL CO., Sidney, Ohio

FOR A GOOD TURN *FASTER* —— TURN TO MONARCH

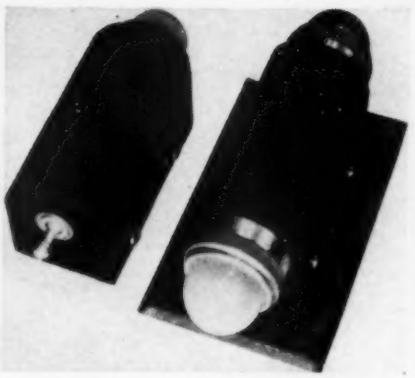
Aro Reversible-Type Screwdriver Drives No. 1 to 10 Machine Screws

An air-powered reversible screwdriver and nut setter, Model 7091, is announced by The Aro Equipment Corp., Bryan, Ohio. The tool will drive No. 1 to 10 machine and wood screws and ¼-in. nuts. The low free speed of 1000 rpm. insures contact with the screw slot, and is said to prevent marring of screw heads. Working speed is approximately 750 rpm.

The reverse mechanism is located on the rear of the motor housing. The tool has an adjustable friction-clutch attachment and is furnished with ¼-in. hex bits and adapters. The tool weighs 2¾ lb.

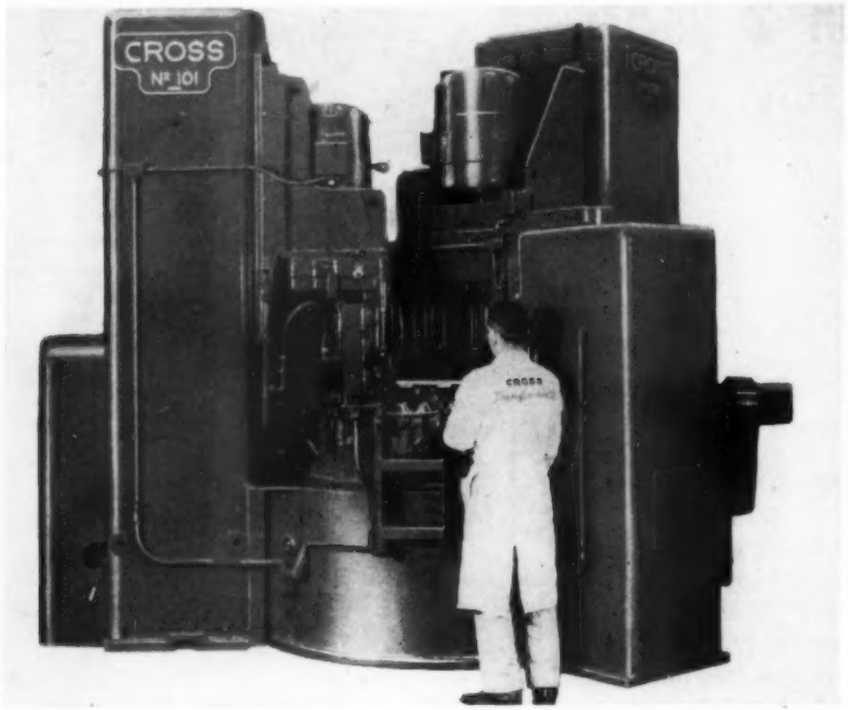


DIAL THICKNESS MEASURES, made by B. C. Ames Co., Waltham 54, Mass., are especially suited for accurate measuring of tissues, cellophane, and similar items. Four models are available, two of which are 0.0005-in.-graduated models. Simple "O" adjustment and fixed parallel contacts are offered. These visual micrometers enable measurements of both compressible and non-compressible material and objects. A 0.001-in.-graduated model and a metric model, graduated in 0.01 mm. are also offered

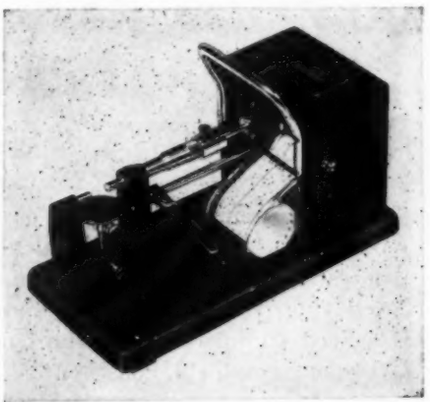


Surface-Type QI Indicating Lamp Works with Varied Holders, Lenses

A surface-type indicating lamp, Type QI, is offered by The H. R. Kirkland Co., Morristown, N. J. The model consists of a die-cast base with a metal shell or cover which is held to the base by two screws on each side. A standard electrical ½-in. knockout is located on the floor of the base to hold the incoming wires. A variety of indicating lampholders and lenses can be used with the housing for all voltages up to 120 v. The standard units are furnished to house one or two lamp units, one or two toggle switches, and a combination of a lamp unit and a toggle switch.



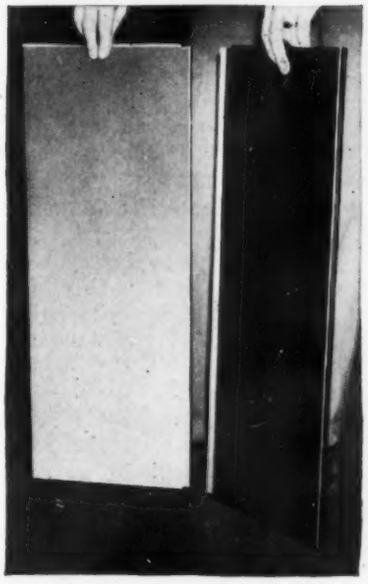
DRILLING, TAPPING MACHINE, of a special design for production of automobile rear-axle differential carriers, is built by The Cross Co., Detroit, Mich. A seven-station machine, it drills, countersinks, and reams 10 flange holes; drills, countersinks, and taps 4 bearing-cap holes; drills and taps the drain hole. Machine is said to complete 150 differential carriers per hr. at 80% efficiency. A pushbutton actuates the power-operated index table. Six pieces are cut at one time progressively. No lifting is required as the parts slide in and out of the machine rails



Dimensional-Recording-Type Gage Measures Piece, Records on Tape

An automatic dimensional-recording gage, Model 500, is marketed by Federal Products Corp., 1144 Eddy St., Providence 1, R. I. The instrument measures a workpiece and records the resulting dimension on a continuous tape which is ruled off in increments of 0.001 and 0.0005 in. The instrument warns the operator before parts are produced which will be outside limits. It is compact, portable, and self-contained. Gage normally has a range of 0 to 1 in. and will check within limits of —0.003 in to +0.003 in. Chart is capable of 35,000 measurements without change.

...and Mullins reports faster production less down time - *with* STURDYBENDER



Two STURDYBENDER Presses set the pace for economical, precision bending in one of Mullins Manufacturing Corporation's plants at Salem, Ohio, where wall cabinets and other kitchen accessories in the well-known Youngstown Kitchen line are made.

Photo above shows flanges being formed on four sides of a wall cabinet door panel. Flat sheets of steel are fed into the press to produce these 24" x 30" flanged panels.

Hundreds of STURDYBENDER Presses in all types of metal working plants are doing faster, more profitable bending and shearing. STURDYBENDER might very well be the answer to your forming problems, too. Why not write for literature TODAY?

THE CYRIL BATH COMPANY
6910 Machinery Avenue • Cleveland 8, Ohio

Parts and Materials

GE Silicone-Oil Release Agent Utilized in Injection Molding

General Electric Co., Waterford, N.Y., introduces the use of GE silicone oil as a mold-release agent in the injection molding of aluminum and zinc die-castings. The oil used in emulsion form is said to facilitate production of certain type die-castings and to help provide a smooth surface on the finished parts. Because of its relatively low surface tension, the GE silicone oil wets the mold readily and penetrates small cavities. The oil withstands temperatures up to 600 F. and can be applied by brushing, spraying, or wiping at the consistency supplied, or after dilution with various solvents.

The silicone is said not to decompose under high heating cycles thus reducing the necessity for frequent cleaning of the mold and allowing closer tolerances to be maintained. The silicone oil is available in three grades with varying viscosities for low-, constant-, or high-temperature service.

Duramite Chemically Inert Paints By Morton Chemical, Resist Heat

The Duramite line of chemically inert paints and coating materials, offering good adhesion and heat resistance, is offered by Morton Chemical Co., Greensboro, N. C. Acids, alkalies, and most corrosive materials are said to have no effect on these products. Materials can be applied by brush, spray, or dip and can be air-dried or baked.

The line includes products for both high- and low-temperature processing, finishes for masonry and concrete, and chemical-resistant floor finishes. Coatings are available in 5-gal. cans and 50-gal. drums.

Indicator-Light Sub-Assembly Is a Neon Unit in Plastic Case

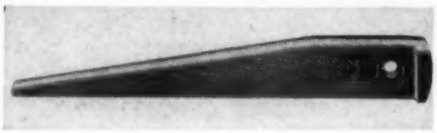
An indicator-light sub-assembly is offered by The American Electronics Corp., 226 N. Fourth St., Columbus 15, Ohio. A neon unit, the sub-assembly has a translucent plastic housing, measuring 1 1/16 in. long with a bullseye of 7/16-in. dia. It incorporates the resistance and a standard NE-2 glow lamp, which transmits a diffused light through the translucent plastic. The unit is provided in a range of colors and a choice of lead-wire arrangements.

Acid Agent Added to Acid Dips Prior to Bright Nickel Plating

An additive called Actane for use in acid dips prior to plating is offered by Enthone, Inc., Dept. AM, New Haven, Conn. This material is added to the acid dips used prior to plating, such as hydrochloric or sulphuric acid. Its function is to disperse and remove colloidal films from the surface of metals that may be deposited during cleaning and which cause the plate to be spotted, streaked, or stained. Results are said to be particularly beneficial for additions to acids for dipping of non-ferrous metals such as copper and brass prior to bright nickel plating.

Bronze-Bearing Pillow Blocks Are of Cast-Iron Construction

A line of porous bronze-bearing pillow blocks is offered by the Precision Products Co., 815 Pryor St., S.W., Atlanta, Georgia. These blocks are of rigid cast-iron construction. The capillary action of the porous-bronze bearing feeds oil to the shaft as needed. Blocks are available in shaft sizes of ½, ⅝, ⅞, 15/16, and 1 in.



REDESIGNED DRILL DRIFTS are offered by The Cleveland Twist Drill Co. A shoulder, or flange, has been added on the head end. The enlarged end prevents the drift from flying through the spindle slot. It is said that the drift is less damaging to babbit hammers. Mushrooming is retarded because of the added metal at the head

Heavy-Duty Mounting by Lord Has Load Capacity to 7500 lb.

Lord Mfg. Co., Erie, Pa., offers the Shockmount, which is designed to control shock, isolate high-frequency vibration, and reduce noise transmittance to the floor. It is a heavy-duty mounting with a load capacity up to 7500 lb. per mount. The flexing element is oil-resistant synthetic rubber.

19 EXTRUDED SHAPES speed re-gauging of hosiery knitting machines

Two sections of a hosiery knitting machine, converted to 51 gauge by Fred C. Good & Sons, Inc., Philadelphia, with extensive use of Revere Extruded Shapes.

LIST OF EXTRUDED SHAPES

Sinker Head with Verge Plate, complete with sinkers and dividers
5 brass extruded shapes

Knocking-Over Bar
2 brass shapes

Welt Bar
2 aluminum extruded shapes

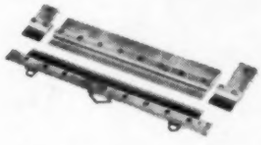
Picot Bar
2 aluminum extruded shapes

Narrowing Fingers
1 brass, 1 aluminum shape

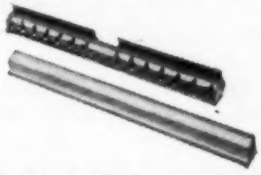
Jack Bed and Spring Bar
5 brass shapes, 1 aluminum

Needle Bar
2 magnesium, 1 brass shape

Some parts of the Sinker Head, and Knocking-Over Bar, with the Extruded Shapes from which they are made.



Narrowing Fingers, Picot Bar, Welt Bar, all using Extruded Shapes.



Needle Bar, with the larger of the two magnesium Extruded Shapes that save so much weight.

YOU would never think that a business such as Revere's would be affected by fashion, but sometimes it is. Take women's hosiery. The demand for sheer stockings has resulted in a tremendous re-gauging of knitting machines, to convert them to 51 gauge from the coarser pre-war gauges. In carrying out such re-gauging, Fred C. Good & Sons, Inc., Philadelphia, Pa., has become a good customer for Revere extruded shapes, which are used in making new essential knitting parts, except, of course, the needles.

The Revere Technical Advisory Service collaborated closely with the Good engineers in this wide use of extruded shapes, with particular attention to flatness, straightness, and uniformity of alloy and temper. Knitting to fine gauges means narrow tolerances. In 51 gauge, for example, 476 sinker slots have to be cut in 14", and the tolerance overall must be held to 0.0015". This requires especially uniform material to begin with, such as Revere supplies and exceptional machining skill.

The demand for finer gauge full-fashioned stockings (50 million dozen pairs per year) has made higher machine speeds desirable. Use of magnesium in the needle bar, the largest vertically-moving part, saves about 2/3 the weight of the previous steel or iron bar, with less vibration and somewhat lower power consumption. But according to the Good company, Revere's chief contributions have been these: supplying uniform metals that can be finished to the closest tolerances, and working out the application of extruded shapes to reduce the amount of machining, making possible lower costs and a higher rate of production . . . Perhaps Revere can do as much for you. No matter what you make, why not ask the nearest Revere Office to send a man over to discuss the advantage of extruded shapes in your business?

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N.Y.—Sales Offices in Principal Cities, Distributors Everywhere.

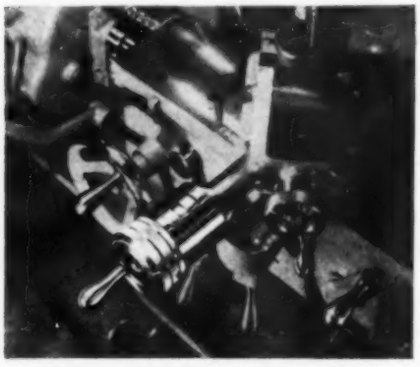
GE Silicone-Rubber Products Include Glass Cloth, Adhesive

A silicone rubber-coated glass cloth which will withstand operating temperatures as high as 520 F., an adhesive for bonding silicone rubber to itself, metals and ceramics, and other applications for molded and extruded materials, are developments announced by General Electric Co., Chemical Dept., Pittsfield, Mass., in the silicone-rubber field.

The rubber-coated glass cloth, which is available in both sheet form and fabricated parts, was designed for use as a gasketing material. It is said to possess good tensile and tear strength and can be applied to many types of electrical and mechanical equipment where high physical properties are required.

The adhesive possesses properties similar to silicone rubber itself, remains flexible and resilient over temperatures ranging from —70 F. to 520 F., and is said to withstand continuous temperatures of 250 to 300 F. in a dry-air circulating oven. It also can be used to bond glass to glass, glass to metals, and metals to metals. The adhesive has been used to secure rubber door gaskets directly to oven doors thus eliminating the need for clamps and bolts. It can also be used for joining the ends of extruded cured stock to form O-rings of uniform thickness.

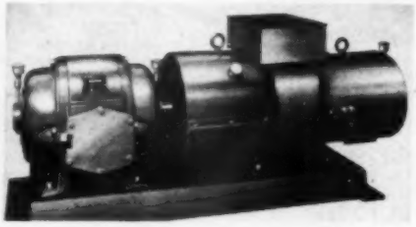
GE silicone rubber is available in extruded shapes, molded parts, sheet stock or fabricated stocks.



Micrometer Cross-Feed Dial Gives Three Direct Readings

Springfield Machine Tool Co., Springfield, Ohio, introduces the TriSet direct-reading micrometer cross-feed dial. Any one of three individual direct readings can be selected for turning, boring, or depth of cut. All three readings are combined in the one indicator.

Direct readings in thousandths of an inch are given through individual windows selected with a knurled ring at the front of the indicator housing. Only one window with one set of graduations is exposed at a time. Each of the three readings for outside diameter, inside diameter, and depth of cut is given on the one dial through its own window. The dial is available on all new Springfield lathes and can be installed on many older models now in use.



High-Frequency Motor-Generators Range in Size from 1 to 250 kw.

A line of high-frequency motor-generators with output frequencies of 300-400 cycles and size range from 1 to 250 kw., are introduced by Bogue Electric Mfg. Co., 40 Iowa Ave., Paterson 3, N. J. The high-frequency power permits operation of machine tools at high speeds without the necessity of costly high-speed gear ratios.

Dayton Rogers Air Receivers Handle All Gases and Liquids

Dayton Rogers Mfg. Co., Minneapolis, Minn., offers air receivers manufactured in sizes from 9- through 170-gal. capacity. The receivers will handle all gases and liquids under pressures up to and including 200 psi. They are furnished with a certified code tag, and are manufactured and inspected according to the ASME code.

Morse-Rockford Friction Clutches Incorporate Over-Center Design

A line of friction clutches embodying the Morse-Rockford over-center design are offered by Morse Chain Co., 7601 Central Ave., Detroit 8, Mich. These toggle-type, small-diameter clutches are available in capacities ranging from 0.5 hp. to 1.7 hp. per 100 rpm. Toggles are assembled with the release mechanism and adjusting plate. Entire assembly comes off in one piece when clutch is disassembled.

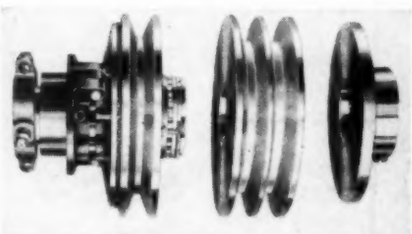
Oil-Resistant Metal Lacquer Adheres to Metal Surfaces

A metal lacquer has been developed by the Dennis Chemical Co., 2701 St., St. Louis, Mo., for use where oil resistance, toughness and adhesion are required. Listed as No. 5062, the lacquer is said to adhere to a variety of metal surfaces and has found particular application over Cronak-treated metals. It is said to withstand 24-hr. immersion in gasoline and 15-min. immersion in hot oil (275 F.) with no apparent deterioration in film strength or gloss. A complete line of colors is available.

Eutectic Paste Confines Flow Of Molten Alloy to Weld Area

A paste, designed to confine the flow of molten alloys to the limited area to be welded, is offered by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y. Called the Anti-Capillary Compound, the paste is for use with Eutectic low-temperature welding rods.

The compound protects the parent metal from discoloration at welding temperatures and assists in retaining the cleanliness and brightness of the metal. The compound can be used with any form of heat, and can be applied by spraying or painting with a brush. It is removed by mechanical action, quenching, wire brushing, or sand blasting. It is available in standard 16-oz. jars containing 1 lb. 4 oz. Surface oxide on the base metal should be filed or ground off.



CLUTCH WITH INTEGRAL V-BELT PULLEY is offered by The Edgemont Machine Co., 2128 Home Ave., Dayton 1, Ohio. The self-contained clutch is applicable to small portable conveyors, and special machinery using V-belt or chain drives. Clutch is furnished in ratings of ¼ and ½ hp. at 100 rpm., and in shaft sizes from ¾ to 1¼ in. It is available with V-belt pulleys with one B-groove of 3½-, 4¼-, and 5-in. P.D., or with two B-grooves of 4¼- or 5-in. P.D.

Sidney Lathes

INCREASE LIFE OF CARBIDE TOOLS

The continuous tooth contact of Sidney's All-Herringbone Geared Headstock produces a smooth flow of power and creates pressure of constant intensity on the cutting tool . . . This constant pressure is especially desirable when using carbide tools by preventing tool breakage caused by shock or intermittent pressures.

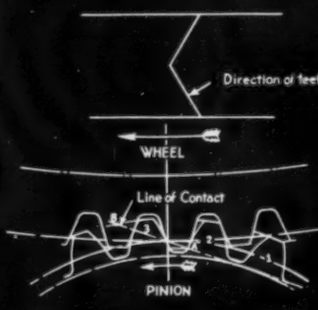


FIG. 9
VIEW IN PLANE OF ROTATION

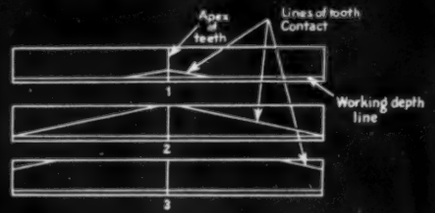
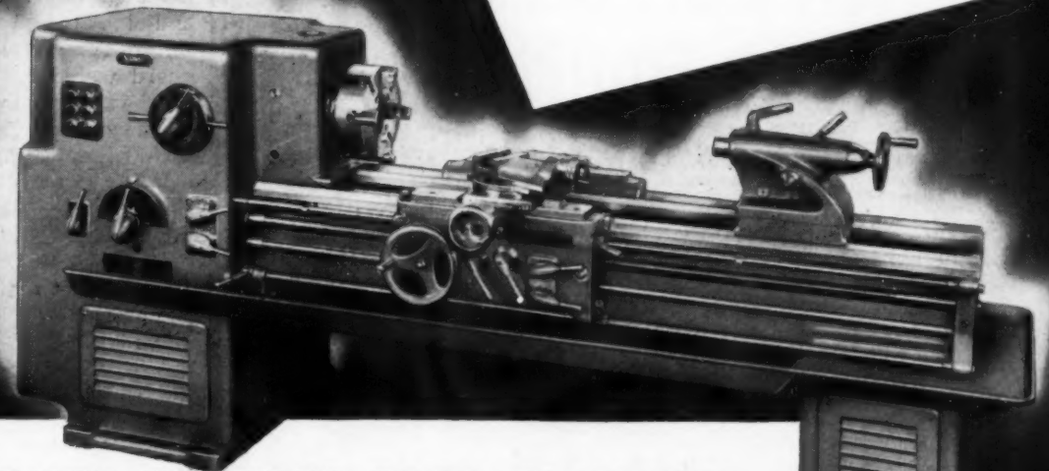


FIG. 10
DEVELOPMENT OF TEETH IN CONTACT.

Illustrated at left is the nature of contact between two herringbone gears. Pressure is evenly divided over three teeth with no tendency for tooth contour to wear unevenly. Full descriptive bulletin available.



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Builders of Precision Machinery Since 1904

SIDNEY, OHIO

Fewer Wheels

With grinding wheels approaching 50% of the total cost to grind high speed tool steel, plant installed a Hoffman Flotation System, to serve 4 grinders.

Result: 88 grinding wheels saved yearly → $8960.00

Less Oil

Coolant saved by clarification in the Hoffman Flotation System amounted to 600 gallons in first year. → 216.00

More Production

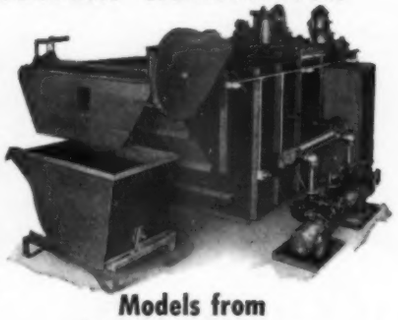
Operators no longer have sumps to clean—they stay on production. Saved on manhours for sump cleaning → 204.00

Total Savings for 1 year $9380.00

All yours with HOFFMAN FLOTATION EQUIPMENT

for *Automatic* coolant clarification

Convert "down" time into production time. And get savings on coolant, wheels and maintenance *more than enough* to pay back your investment. That, in very brief, is the story on the HOFFMAN Flotation System for coolant clarification. To get the complete details, write for bulletin A-690.



Models from 20 to 1,000 g. p. m.

U. S. HOFFMAN MACHINERY CORPORATION 211 Lamson St., Syracuse, N.Y.

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ROUND TABLE *Discussion*

GUARDS OR PRODUCTION

While it is possible to symphathize with Ed when he feels that guards tend to slow up production, careful thought is desirable before arriving at an unfavorable conclusion. It may be that the number of guards specified appear to suggest undue caution, but the decision as to their actual need is not so much a question of guards versus production as production with or without injury or loss of limb. This seems to be a question of experience and common sense and one where the advice of the "old man" would probably prove to be really valuable.

Accidents are not confined to the incompetent; rather it may be the man who takes risks, like the man who takes a short cut on the railway track or crosses a stream by an unsafe means to save time. Failure may be fatal. Too late this type of man may realize the value of discarded guards. It is the unguarded movement that is to be the most feared, and the presence of the guard is a safety factor.

A machinist once lost a finger through its being crushed in the teeth of change wheels. Later on, another man was explaining to the factory inspector how the accident had taken place. He was so intent on his description that he allowed his own finger to become trapped and he, too, became a casualty. Silly? Yes. Avoidable? Yes. But a guard would have avoided both. It is of value to look at the question in retrospect. Are there as many maimed and crippled workers today as there were 50 or 60 years ago? The answer is certainly, "No!" Then surely we should root for guards and safety for workers, and production will not really suffer. After all, the prone-to-accident people will always be with us.

J. E. Powell
Lincoln, England

•

WHO HIRES THE BOSS?

When a man is hired to do a certain kind of work, his place in the industrial machine is to perform that work to the best of his ability under the direct supervision of the one in charge. He does not become one of the directing factors in the operation of that machine. There is a limit to his power of observation; his ability

GET COSTS DOWN

"Out of the Air"

and put a fresh breeze behind sales...

...the way Air Conditioners do it with AMERICAN PHILLIPS SCREWS

DEFLATE COSTS . . . like one of the largest refrigerator and air conditioner manufacturers . . . who says: "Our present high production would not have been possible without American Phillips Screws . . . *which permitted the efficient use of power drivers.*" And which *did not permit* any more driver skids, spoiled work, dropped screws, burred screw heads, slashed hands. Now, labor costs keep in line, as do material costs. And time savings run as much as 50%.

INFLATE SALES with the modern, inviting look of American Phillips Screws. The clean-edged, tapered recess flashes the message of quality *instantly* to the buyer's eye. And remember, too, that in any motorized merchandise, the special vibration-resistance of American Phillips Screws has a lot to do with *keeping customers sold.* Let American engineers translate these Phillips advantages *in specific terms of your own product.* Write.

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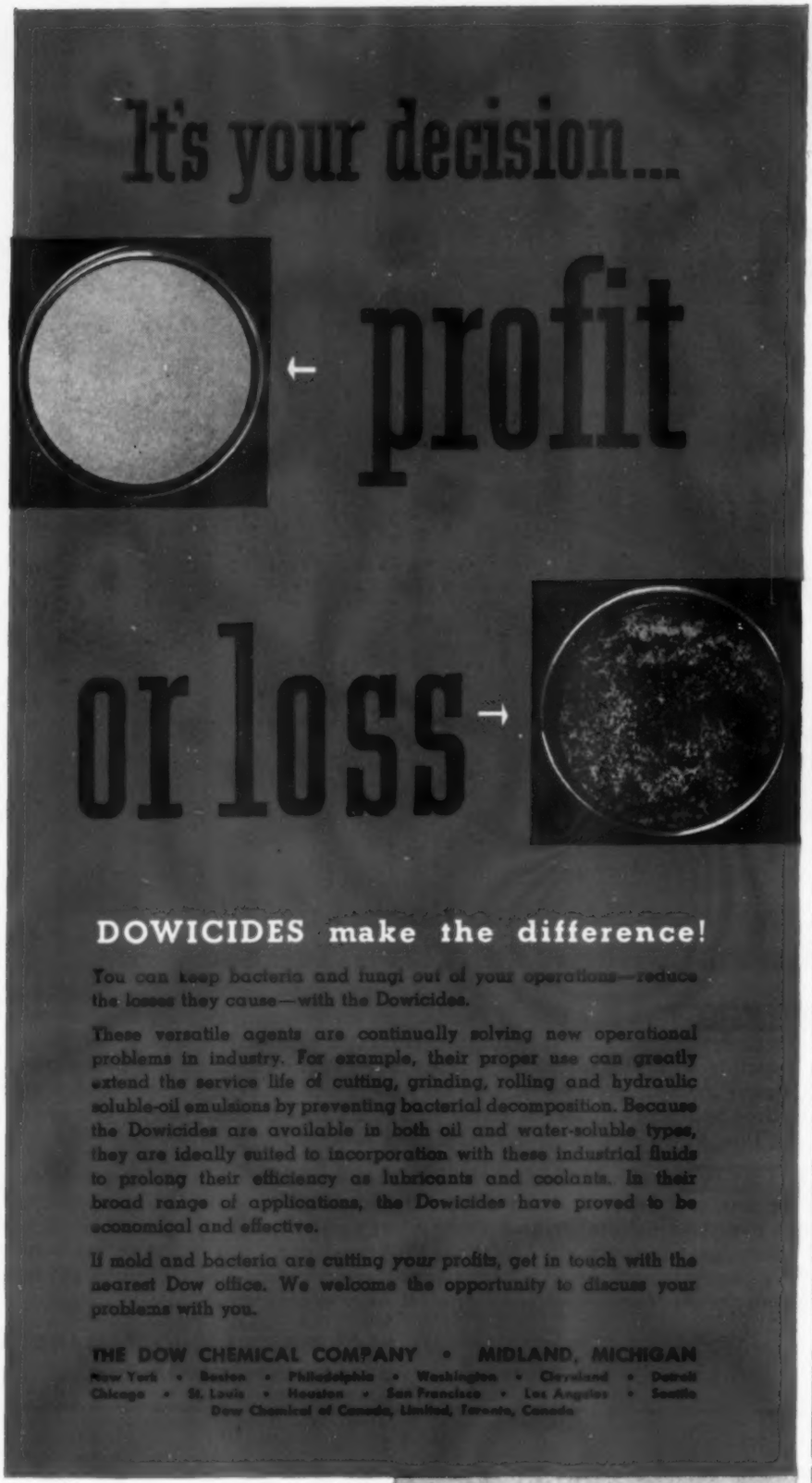
AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)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profit
or loss
DOWICIDES make the difference!
You can keep bacteria and fungi out of your operations—reduce the losses they cause—with the Dowicides.
These versatile agents are continually solving new operational problems in industry. For example, their proper use can greatly extend the service life of cutting, grinding, rolling and hydraulic soluble-oil emulsions by preventing bacterial decomposition. Because the Dowicides are available in both oil and water-soluble types, they are ideally suited to incorporation with these industrial fluids to prolong their efficiency as lubricants and coolants. In their broad range of applications, the Dowicides have proved to be economical and effective.
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CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

to see what is going on throughout the plant is decidedly limited, especially in a large establishment. Thus, his evaluation of the true worth of an executive cannot be a deciding factor in determining this point.

If Sampson is being replaced by another superintendent, there must be some good reason for management making such a change. There may be times when management is guilty of poor judgment, but invariably matters of vital consequence are weighed very carefully before any decisions are made. The changing of a shop superintendent is no small matter; it can make or break a smooth-working organization in a short time.

Ed seems to be looking at the whole picture through the wrong end of the industrial telescope. Were I approached with such a petition, I would refuse to sign it simply on the grounds that the whole matter was not my concern, notwithstanding that Sampson may have treated me like a prince throughout the length of our long association. Personally, I take pride in minding my own business, and it is for that reason that I think Ed is suffering a mental hangover.

Successful business, as we in America understand it, is directed from the top—not the bottom.

J. Homewood
Ontario, Calif.

•

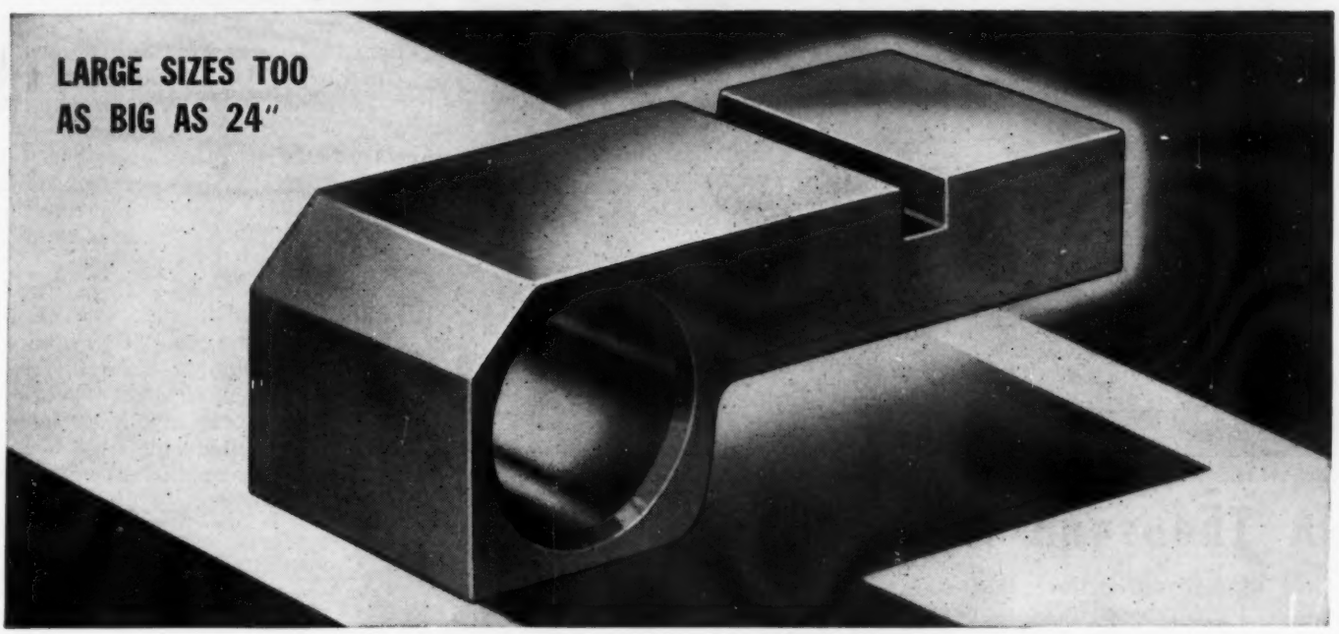
The idea that the working man should give articulation to his conception of how his plant should be operated is identical, with its accompanying obstacles, to all routes of progress.

Does it take a socialist or communist to want to protect his "interests," which are solely the knowledge of his craft? The intagibility of this investment is such that it cannot be measured in dollars and cents. However, it is only because of this interest that "openhouse" meetings in many industries are such a success. Their purpose is to fan the flames of pride in worker accomplishment. The inarticulate, immigrant wife of a "bull-worker" who brings up raw stock to some ponderous machine, or does the oiling, knows that but for "her man" the great mass would not, could not, produce. Children can tell it as "My Dad's machine."

"Open House" cannot happen quarterly—but the recognition, the return, can. The same spirit in management that recognizes the investment and interest of the worker and that prompts such returns as an "open-house" also knows the worker to be a human being.

OILITE

Finished MACHINE PARTS



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Finished OILITE parts made from metal powders offer you many advantages including the following:

- ★ **Precision parts at lower cost.**
- ★ **More than 20 types of machining operations eliminated.**
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- ★ **No capital investment or tooling programs on your part.**
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- ★ **Parts of either ferrous or non-ferrous materials.**
- ★ **Metallurgically and structurally homogeneous—no imperfections.**
- ★ **Self-lubricating surfaces if desired.**
- ★ **Quicker delivery assured.**

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FIELD ENGINEERS AND SUPPLY DEPOTS IN PRINCIPAL CITIES

A Thousand Improvements a Year

We at Ryerson believe that constant improvement in every operation is the key to good steel-service. We continually invent, revamp, revise, reorganize—*improve*. Best of all, our employees help show us the way.

Last year, for instance, our employees submitted a total of 3,686 suggestions, each of which described a procedure, policy or piece of equipment designed to improve the efficiency of our steel service. Of the 3,686 ideas, 1,379 proved worthy of cash awards and are now being used to the ultimate benefit of Ryerson customers. Accepted suggestions ranged from a method of speeding the paper work in processing an order to more accurate gauges for our biggest friction saws.

This willingness of our entire organization to help achieve maximum efficiency is one reason we are able to promise you a steel-service that's intelligent, ever alert to do the job still better. Encouraged to advance their own ideas, our employees often assist in determining practical alternates when great demand causes shortages of the steel you need. To put this kind of service to work for you, contact the nearest Ryerson plant next time you need steel. You can be sure we shall do our best to serve you.

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BARS — Carbon and alloy, hot rolled and cold fin., reinforcing
STRUCTURALS — Channels, angles, beams, etc.
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Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco.

RYERSON STEEL

Management is often fond of saying, "What do they know of the struggles we went through? They never sweated out a payroll." But how about he who sweats out a doctor's bill for a new-born child? Both contingencies should be boiled down to the human quotient. On a plane of $50 and $5,000, they become so similar as to be called identical.

Small wonder, therefore, that any man in direct contact with the working men, who has bid them good morning, given them a fair deal (which has nothing to do with granting a nickel an hour every time it is asked for), becomes subject of a petition to management upon his discharge, often regardless of his managerial offense, for it is through him that these workers receive the balance of the dividend due us all—appreciation.

To such an executive, in direct contact with labor, there can be no finer tribute paid than, "He's square; you can't let him go." Any management on receipt of such a petition should pause before yelling "Interference! Dictation!" for what is not only an expression, but protection of legitimate interest.

A. M. Elliott
LeRoy, N. Y.

•

BACK UP OR BACK OUT?

Ed seems a bit perturbed because Al has been away from the shop quite a bit, leaving his Number Two man, Billings, in charge. He thinks that Al's pinch-hitter may outshine him and jeopardize his standing with the management.

Anyone with shop experience is aware that Al is really leaving himself wide open. However, he is big enough to give another man a break and in so doing proves that he is a pretty smart man. He is putting the best interests of his company first and no doubt will come out on top himself.

In large plants, they must have men like Billings who can take over in the foreman's absence without disrupting production and schedules. The top man isn't going to be on the job every day, or forever, and it's the wise man who has a good successor lined up and trained to take over for him.

I was employed many years ago in a large repair plant in which the superintendent was the only big shot supervising about 50 different types of workers. One day, after about 45 years on the job, he dropped dead in the shop. Everything went haywire. No one had ever been trained

THE ROTARIES

for FAST CUTTING PERFECT BALANCE LONG LIFE

Whether you buy them in kit assortments or in specified quantities per type, size and cut (coarseness), Nicholson Rotary Files and Ground-from-solid Burs carry the same assurance of efficient and economical performance as the Nicholson hand files which for years have been marketed under the guarantee of *Twelve perfect files in every dozen.*

Nicholson Rotaries are of the highest standards — in precision design, in exacting workmanship, and in long-wearing hardness and toughness.

Your industrial distributor can supply you and give you helpful assistance in selecting *The right file for the job* from among Nicholson lines briefly described below. Detailed catalog sheets and prices are available.

HIGH SPEED STEEL—1/4" SHANK—*Hand Cut Rotary Files*—principally for ferrous metals and other hard materials—in 16 standard shapes and 3 degrees of coarseness.

***Ground-from-solid Burs*—**principally for non-ferrous metals and other soft materials—in 16 standard shapes and 3 degrees of coarseness.

CARBIDE—1/4" SHANK—*Ground Bur* type only—in 9 standard shapes and 3 degrees of coarseness. With up to 100 times the wearing qualities of high speed steel, Carbide Burs are ideal for long production runs.

HIGH SPEED STEEL—1/8" SHANK—*Hand Cut Rotary Files* and *Ground-from-solid Burs*— each in 18 standard shapes similar to 1/4"-shank line and one degree of coarseness. For relatively delicate work.

• • •

NICHOLSON FILE COMPANY, 97 Acorn Street, Providence 1, Rhode Island

(In Canada, Port Hope, Ont.)

NICHOLSON ROTARY FILES NICHOLSON U.S.A.

PRECISION GROUND AND HAND CUT **HIGH SPEED STEEL AND CARBIDE**

Press Die Feeding Offers Tremendous Savings Over Hand Feeding

Basing a feeder's time at $1.25 per hour, the average hand feeder can produce a maximum of 2,000 pieces per hour, or only 16,000 pieces per day at a labor cost of $10 for 16,000 units. The same press equipped with automatic die feeds and running at 123 RPM on a basis of 83% efficiency will produce 48,000 pieces in the same period . . . an actual saving of $20 per day.

Figuring on this very conservative basis, Dickerman Die Feeds will pay for themselves, out of labor alone, as follows . . . 2" Hitch Feed, 2 days . . . 4" Hitch Feed, 7 days . . . 3" Die Feed in 14 days . . . 6" x 4" Die Feed in 21.2 days and a 6" x 6" Die Feed in 26.2 days. Equally important is the fact that these die feeds can operate for long periods unattended, thereby saving operator's time for other duties.

The AUTOMATIC FEED FOR any PRESS

If you're NOT using Dickerman DIE FEEDS you're NOT making the PROFITS you should be. Increases of up to 300% in Production are not uncommon when plants are modernized the Dickerman way. Use them on your present presses . . . avoid costly jams and crackups. Don't follow competitors . . . lead them.

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J. F. Owens Machinery Co.
Syracuse, N. Y.
Syracuse 5-2632 — 5-2639

to replace him, so the shop was left without one person who could take the reins. All kinds of jobs were left uncompleted about which no one knew anything, and it took a long time to unravel the mess. The result was that the shop took a serious loss and came near to having to close down. Had the deceased superintendent had the foresight, or the bigness, to train a Number Two man, this would not have happened.

As far as Billings' lack of seniority is concerned, I am in full accord with Al's views. It has been proved time and again that the oldest worker, from the standpoint of service, isn't always the smartest or the most capable. Too, years of service don't necessarily always have to turn out a man of executive calibre. Some men just never will have it. Therefore, when you want someone for a supervisory job, it is common sense to choose the best man, judging him not by seniority, but by his ability, experience, attitude and all other qualifications that make a good top man. If any two men measure up to all of these equally, then let seniority decide between them.

Arthur Silvester
Niantic, Conn.

•

Unpredictable changes make it necessary for management to keep on tap a supply of key men. A No. 1 man requires a complementary No. 2 man to provide continuous successful operation of a plant.

A substitute for each executive within an organization is essential. This substitute must be available to act in case of illness of enforced absence of the supervisor ,and must be capable of taking over his work in case of death or change of duties.

In the industrial army, as in the fighting army, the company without a head seldom reaches the objective. If there is a capable substitute, it will always be possible to have a head for the shop or the department. However, if a plan of substitutes for executives is being developed, it is essential that all members of the organization have complete confidence in the purpose behind the plan. If they feel that the plan is merely a club to be held over their heads, so that if they do not prove successful at any time they can easily be removed, the plan will fail. The legitimate purpose of the plan should be made known. These are, in the first place, to have an executive on duty at all times, and, in the second place, to offer opportunity for advancement, either as executives leave or as the business grows.

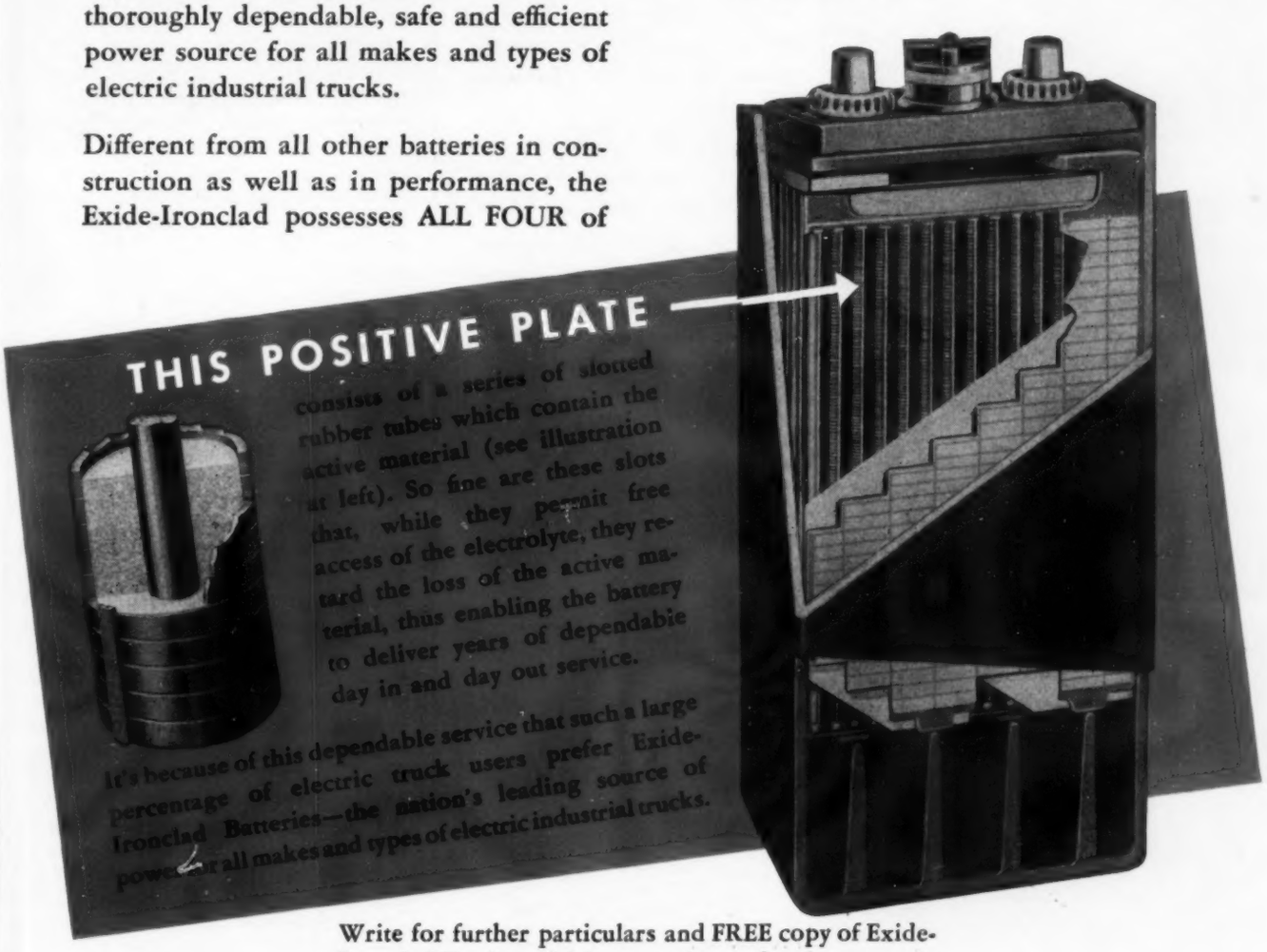
Although the desirability of this

USERS EXPRESS PREFERENCE FOR Exide IRONCLAD BATTERIES

IN a recent national survey made by a leading industrial publication, 81.1% of electric industrial truck users expressed a preference for Exide-Ironclad Batteries.

Such overwhelming preference for the Exide-Ironclad Battery is based upon user experience. This unique battery has, during the past 35 years, proved itself to be a thoroughly dependable, safe and efficient power source for all makes and types of electric industrial trucks.

Different from all other batteries in construction as well as in performance, the Exide-Ironclad possesses ALL FOUR of the essential characteristics demanded of a battery for electric industrial truck service—(1) high power ability, (2) high efficiency, (3) great ruggedness, and (4) long life. These characteristics are due to the special construction of the Exide-Ironclad Battery, especially its rugged, tubular positive plate.


THIS POSITIVE PLATE
consists of a series of slotted rubber tubes which contain the active material (see illustration at left). So fine are these slots that, while they permit free access of the electrolyte, they retard the loss of the active material, thus enabling the battery to deliver years of dependable day in and day out service.
It's because of this dependable service that such a large percentage of electric truck users prefer Exide-Ironclad Batteries—the nation's leading source of power for all makes and types of electric industrial trucks.

Write for further particulars and FREE copy of Exide-Ironclad Topics, which covers latest developments in material handling and shows actual case histories.

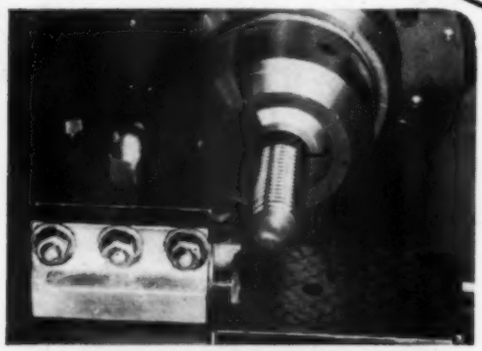
1888...Dependable Batteries for 60 Years...1948

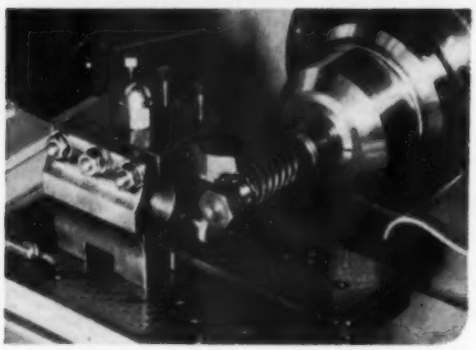
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

NEVER BEFORE such THREADING SPEEDS and VERSATILITY!

48 Seconds
CYL. HEAD STUD
SAE 4140 Heat Treated 800 RPM
1" Dia. 8P Length 2"
Single thread.
Actual threading time 48 Sec.

Check these
CRI-DAN THREADING FIGURES
against your own threading production





- **Single Point, high speed or carbide tool threading generates threads at speeds once thought impossible.**
- **100 Passes Per Minute are attained in traversing the cutting tool through the cut.**
- **Speedy, 15 Min. Changeover in generating exterior, interior, right or left hand, tapered, round, square, trapezoidal, buttress, multistart or special threads.**

Write for Bulletin A-72

22 Seconds
AXLE SHAFT
SAE 1033 Rockwell C31 800 RPM
⅞" Dia. 14P Length ⅞"
Single thread.
Actual threading time 22 Sec.

50 Seconds
STARTER DRIVE SCREW
Material SAE 1020 550 RPM
1" Dia. 3 Starts Length 1¾"
1¼ threads per inch, 800 lead.
Actual threading time 50 Sec.

The LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

arrangement is generally recognized, it is not always possible to pick the proper understudy. The contention that seniority should have first consideration has been advanced as a strong argument for improving and maintaining good worker morale. However, the best interests of management demand that the most efficient and capable worker be selected as the possible future No. 1 man. The potential supervisor must also be judged on the basis of his leadership qualities, as well as his capabilities as a mechanic. It is therefore evident that in the selection of a subordinate, it is necessary to take several factors into account. Selection by seniority may be good for morale, but selection on the basis of worker efficiency, sound judgment, and experience in the work will prove of greater value to both management and labor.

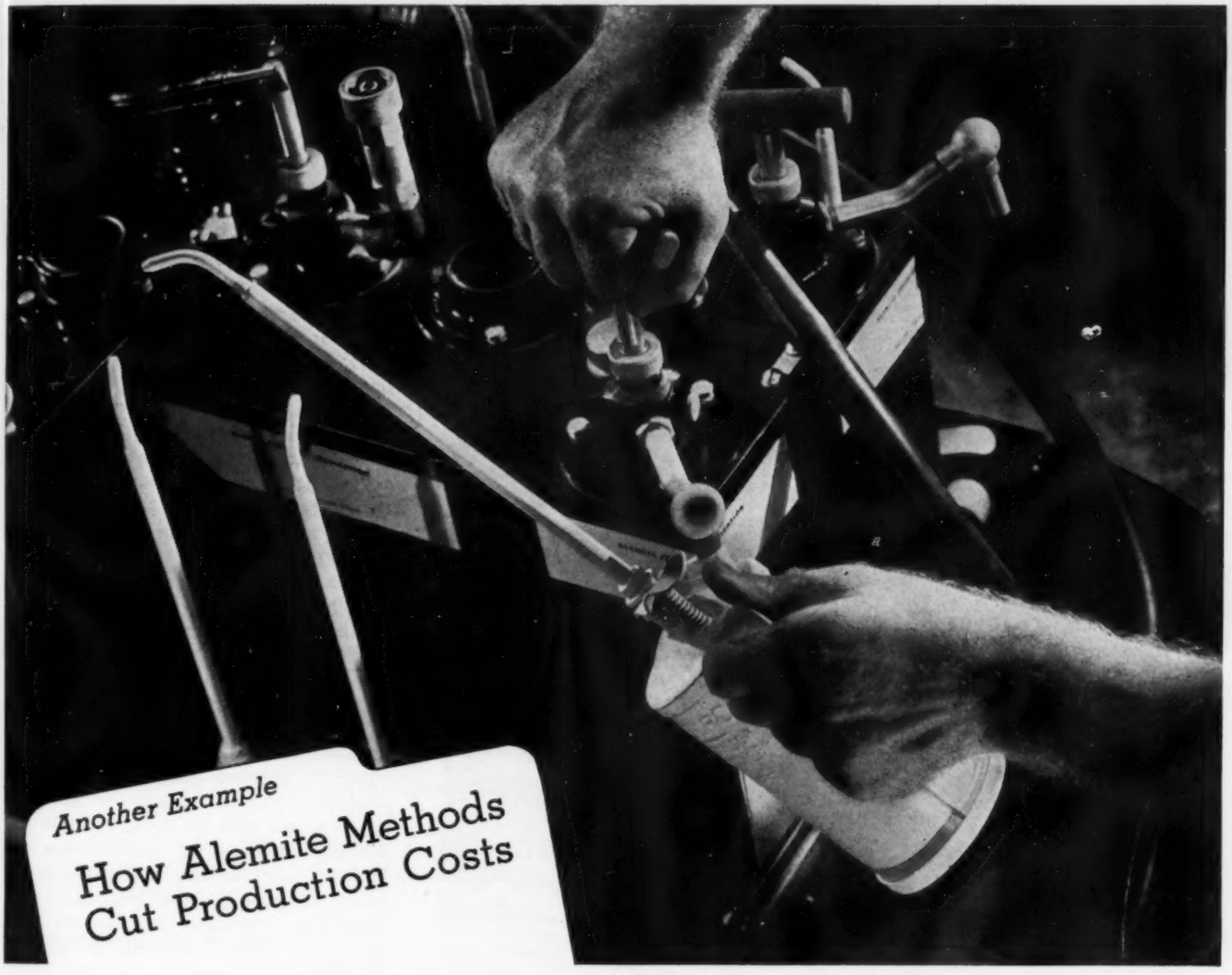
It is essential that mere seniority should not govern organization development. Education and intelligence levels should be considered. It is true that in large organizations some orderly arrangement of promotion, with length of service as a factor, must be worked out. Listlessness is usually displayed by employees in those companies where promotion or organization development is based solely on seniority. No amount of effort on the part of management seems to bring the personnel above the mere level of average, position-retaining performance when this policy is followed.

It is important that during the period of supervisory apprenticeship, the future supervisor be given an opportunity to demonstrate whether or not he possesses latent supervisory abilities and has the possibilities of developing into an executive. Fixed responsibility acts as an incentive to a subordinate. He will work harder, more wholeheartedly, and in a more sustained manner for the purpose on hand when he has some share in forming plans, and in devising methods. He must be encouraged to suggest ways of overcoming difficulties. His knowledge, experience, and information about detail must be developed, as well as his possible leadership ability.

It should be remembered that in the ability and action of the subordinate lies the safety factor of an organization; if it doesn't exist, the executive structure may collapse under the strain of unusual pressure.

Time and tide wait for no man or organization, and the supervisor who provides for an understudy is a far-seeing intelligent man.

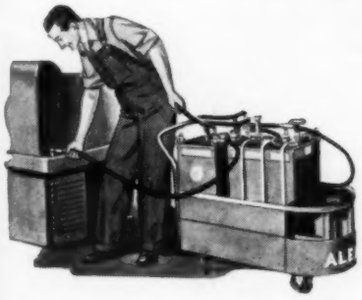
Harry Kaufman
Phila., Pa.



Another Example

How Alemite Methods Cut Production Costs

Slashes Downtime for Lubrication Up to 35.3%



Adds More Productive Time to Machines by Mechanizing the Handling and Application of Lubricants

Your machines demand many different types and grades of oils and greases. That's why you need an Alemite LubriKart—a complete, portable lubrication department on wheels. Everything an oiler needs is within arm's reach. Result—he can service any machine in as much as 35.3% less time—adding more productive time to each machine.

This is just one of many Alemite Methods that help to cut production costs. And the Alemite Representative can quickly prove that his simplification of lubrication procedures definitely reduces maintenance costs in any plant, large or small.

He can show you case after case where a time study analysis proves that Alemite Methods eliminate costly, time-consuming handling of greases and oils. His methods completely mechanize lubrication from-barrel-to-bearing...keep dirt out of grease . . . reduce bearing failures. He can show you how to lubricate as many as 300 bearings from *one* safe central point while the machines keep on producing! Get the complete facts today!

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Your Lubrication Methods May Be More Antiquated Than You Suspect

Shown above is an Alemite LubriKart being used to fill a gear case. Compare this modern, compact, efficient unit with your own lubrication methods. If yours fall short—remember that the Alemite Representative is a specialist in modern methods of handling and applying lubricants. A five minute conference with him may open your eyes to new cost-cutting ideas. Call your Alemite jobber or write to Alemite, 1899 Diversey Parkway, Chicago 14, Illinois.

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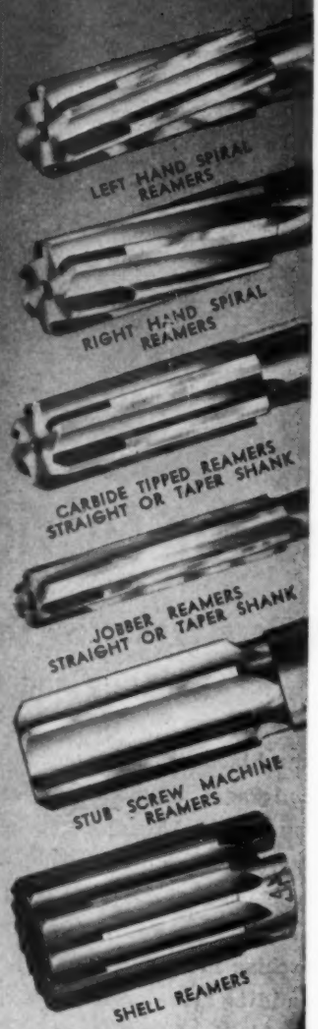
LEFT HAND SPIRAL REAMERS
RIGHT HAND SPIRAL REAMERS
CARBIDE TIPPED REAMERS STRAIGHT OR TAPER SHANK
JOBBER REAMERS STRAIGHT OR TAPER SHANK
STUB SCREW MACHINE REAMERS
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BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

Under normal conditions, sufficient instructions may be given and watchfulness in processing be taken care of properly by the regular foreman, but there are sure to be times when a foreman has more irons in the fire than he can properly watch. At such times his understudy can and should be a great help.

The foreman who is slow to train an understudy or shows an unwillingness to impart to another anything except those things that are quite apparent, is very likely to be looked upon with suspicion. He will not be given the respect and backing that he should have.

The man liberal in his disposition is benefited in two ways: His superiors in position regard him as a likely prospect for a higher position. He can leave his present position knowing it will be cared for satisfactorily, while he steps up to a higher one that all concerned feel has been justly earned.

John Mark May
Watervliet, N. Y.

•

I'm for Al. A guy with his point of view is headed for management. However, it is not always what you do, but how you do it. If Al spends his time making an understudy of Billings with the idea that he would have someone to step in his place should management call him to another job, that's fine, but if that is all, then he is wasting his time. His next move is to select the job he wants, the one he feels he can do, and make a study of it, getting all the angles well under control.

At the same time, and while Billings is taking some of the pressure off him, Al should be concentrating on better methods, more production, and new ideas in his own department.

The improved showing of his department will be his advertisement to management. His knowledge of his next job will be his sales ammunition and his attitude and loyalty the ticket that will take him into a better job.

J. E. Smith
Centralia, Mo.

•

IS BLUE MONDAY INEVITABLE?

When a shop workman walks out at the end of the week, he is at the beginning of a recreation period in which he can plan things to meet the wishes of his family and friends, as well as himself. He will want to tell some friends in the shop about his activities when he returns on Monday morning, and things start

Sunbeam STEWART WIDE RANGE OVEN

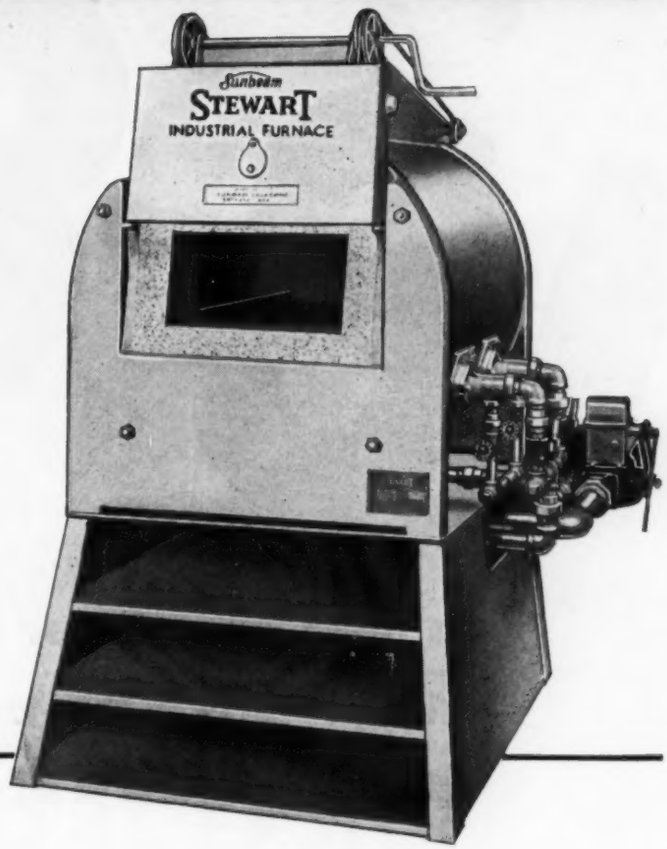
THE BEST INDUSTRIAL FURNACES MADE

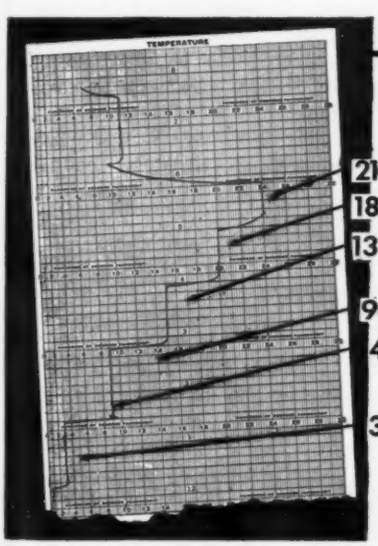
(OPERATING RANGE 300°-2400°F.)

Covers practically every phase of heat treatment ALL IN ONE FURNACE - -

- **Temperatures from 300°—2400° and any intermediate temperature.**
- **Sunbeam Stewart wide range burners can be adjusted from a reducing to an oxidizing atmosphere.**
- **Rapid high heat—quick return to low heat.**

Designed for all types of heat treating—from low temperature draws to hardening of high speed steels. Wide range operation *in one furnace* eliminates need for two furnaces of different temperature ranges. This spread of 2100°F. is made possible by new Sunbeam Stewart burners which permit a 95% turn-down range of fuel. Mail coupon below for complete information on the size to meet your needs.





IDEAL FOR SHOP OR GENERAL PLANT USE

Temperature chart at left shows *why* this Semi-muffle Oven answers the long felt need for a small furnace flexible and efficient for performing a variety of heat treating operations. *300° in 5 mins.—held 70 mins. 300 to 900° in 3 mins.—held 80 mins. 900 to 1500° in 7 mins.—held 60 mins. 1500 to 2000° in 13 mins.—held 50 mins. 2000 to 2400° in 12 mins.—held 40 mins. Returns from 2400 to 1100° in 20 mins.—held 80 mins.*

Get information on this Sunbeam Stewart Oven today. Moderately priced, it may be just the furnace you need for the various heat treating jobs in your plant. Check your requirements on coupon below. We'll be glad to give you complete information at no obligation.

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Heating Space: ☐ 4"x8"x12" ☐ 6"x12"x18" ☐ 9"x15"x24"

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it *will* save your money

it *may* save a product

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NO other alloy satisfies the exacting demands of industry in so wide a range of applications as Circle Ⓛ 22, the time-tested "18 and 8". It is saving money every hour of every day by lengthening equipment life, cutting repairs and plant "down-time". It guards product quality against contamination by corrosion. In handling dangerous gases and liquors, men's lives depend on the integrity of castings made from this "18 and 8" alloy.

A set of data sheets describing Circle Ⓛ 22, 22 M and 22 XM, Lebanon's "18 and 8" alloys, is yours for the asking.

LEBANON CIRCLE Ⓛ 22

An "18-8" Alloy

NOMINAL ANALYSIS

Carbon Max.	0.07
Silicon	1.25
Manganese	0.75
Chromium	19.50
Nickel	9.00

NOMINAL PHYSICAL PROPERTIES

Tensile Strength	75,000
Yield Point	36,000
Elongation in 2"—%	50
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ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *ALLOY AND STEEL* Castings

CIRCLE L

off with a better feeling all around when this freedom is encouraged and not frowned upon.

It would seem wise not to put too much pressure on the men on Monday mornings, but let the good feelings of the weekend have their leavening effect, which often carries through the week.

The blue Monday is centered very largely on those who have a hangover from a weekend's overindulgence, and they very often both feel and see blue.

Abel Blakeman
Watervliet, N. Y.

•

There are good reasons today that point in favor of a later start on Monday, especially in the big cities. One reason is that week-end travel hampers schedules and makes Monday a.m. commuters late or upset. By the time some blow off about this and that, the first hour or two are unprofitable ones for the company.

In one plant, where Monday a.m. traffic is terrific, it was considered, but never put into effect, working Saturday a.m. and starting work Monday noon. But those who could get to work fought the boys who could not, and dissension defeated the plan. In the smaller city it may not be a problem, for the men can generally be on time.

During the last war, to eliminate some of this late motion on Monday, several of us went in to a big toolroom on Sundays for several hours to lay out fresh work, and overcame late starts. No one wants to keep that up in peace time, so there are many advantages in the later starting time.

J. H. Rasmussen
Niagara Falls, N. Y.

•

DEADLINE OR DEAD TIME?

Back in the late 90's, every man in the shop was required to work right up to the time when the hands of the clock showed 12 noon or 6 p.m.

A man who was caught even wiping the machine oil from his hands ahead of time was subject to harsh remarks from his foreman, and if he had his coat on in readiness to leave at six sharp, he might be laid off for a few days, or even be discharged.

The first innovation was when the foreman was instructed to allow two minutes for cleaning up; so, when the "brush up" call came, everybody got busy and cleaned his machine. This induced men to keep their machines in a cleanly condition at all times, and they voluntarily made

sure that no chips were gathering under their feet. This in itself was worthwhile.

Later, we began to work at 6:55 a.m. and 12:55 noon. By doing this six days per week, we had worked 60 hours by 5 p.m. on Saturday, so we quit at that time.

Nowadays, it is entirely different and the men are not so thoroughly supervised as in the old days. (Not "good old days").

The employees in general are now given more latitude and almost to a man, this short period, as mentioned by Al, is appreciated, and they feel that life is made much more pleasant for them by the firm. Al has the right idea and is not often imposed upon probably. By allowing this short period, there is less "let down" and the men work right up to the minute. True, employees are getting much more in the pay envelope and this has a psychological bearing on the subject, but, how much better men feel and how much more pleasantly employees in the shop feel!

As Al says, he has to lead men, and if this is properly done, he and the firm do not suffer, for evidently, there is no place for a grouch there.

Under the conditions as explained by Al, there must be very little labor turnover and that, in itself, helps to keep the employer in a prosperous condition, for it cost a lot to break in new men, and where the terms of the work are good, there one will find the best men.

F. H. Stebbins
Worcester, N. Y.

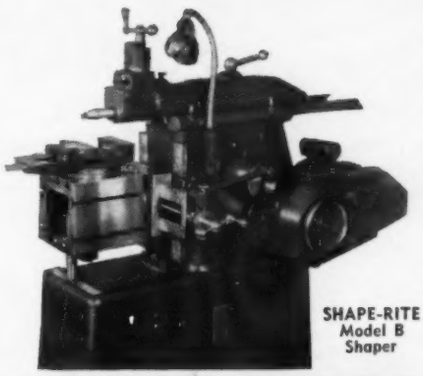
•

Back in the days when union shops were few and far between, I worked for a medium-sized concern whose reputation as a good shop to work in was known to the machinist fraternity far and wide. It was the first shop in my working experience that allowed employees ten minutes of company time at the close of the working day for the purpose of washing up and changing clothes. In addition, there was plenty of hot water and a roomy locker for each man. To my knowledge, abuse of the washup time was not tolerated by the employees, and the individual who jeopardized this privilege soon found himself in hot water in more ways than one.

At the other end of the same town, there was another plant whose reputation was also known far and wide, but for a different reason. No self-respecting machinist would apply there for work unless from

Increase Your Output with Faster Setups -

use the efficient SHAPE-RITE SHAPER



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SHAPE-RITE SHAPERS are engineered to provide faster set-ups . . . one of the most important elements for greater production.

Maximum versatility . . . controls within easy reach . . . and many other built-in features cut set-up time to a minimum and eliminate many costly jobs.

Furnished with plain or swiveled table, the SHAPE-RITE SHAPER provides fast, economical operation. Investigate it now!

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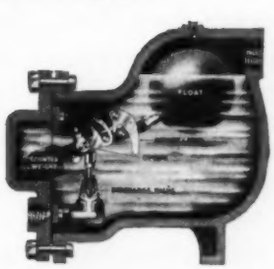
These 4 Nicholson Units Help You

DO IT FASTER

The time saved by these Nicholson units is a matter of record in shops the nation over.

NICHOLSON CYLINDER CONTROL VALVES — Custom construction for specific mediums saves maintenance time. Pressures to 5000 lbs. Catalog 546.



NICHOLSON ARBOR PRESSES —Service records show they deliver the necessary punch, smoothly. 5 sizes for work to 20" diam. Bulletin 845.

NICHOLSON AIR TRAPS feature a positive fluid seal, assuring quick and efficient drainage of intercoolers, aftercoolers, separators, tanks, etc. Instantaneous action due to weight operation; hardened stainless steel where it counts. Nicholoson Catalog 448 describes drainage methods for all mediums.

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"KEX" Industrial Wiping TOWELS

New Atlanta Ford Plant Joins Ranks of "KEX" Users

THIS is the latest of the many Ford Motor Company plants to select KEX Industrial Wiping Towels because they work so efficiently at low cost.

"KEX" National Service is available for all types of industry in every section of the country. This service consists of a simple, quick and logical way to rent industrial wiping towels of uniform quality—made for the use to which you put them.

They are delivered in any quantity to suit the individual requirements of your plant . . . and are exchanged at regular intervals to insure an adequate supply of clean towels. They come in neat, easily handled bundles that help control distribution. Every towel is thoroughly cleaned and inspected before delivery.

Follow the lead of industrial leaders who overlook no opportunity to keep operating costs down—and efficiency up!

Nothing to Buy—No Expensive Inventory—Just a Low Monthly Rental. The first month should show a decided saving on wiping costs.

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ignorance or strictly from hunger. This place was "systematized" to the nth degree, without consideration or regard for the employees. The foremen were under orders to patrol their departments half an hour before quitting time for the purpose of seeing that there was no "letup." The result was a continual feeling of resentment on the part of the employees and a continued and successful effort to "do" the company at every turn. Any piece of material or equipment that wasn't too heavy to lift or too bulky to conceal had a tendency to disappear!

It was told that one individual who worked for this concern was partial to a derby hat. It was quite a while before the company discovered that the headgear had covered more than its owner's head as he left at quitting time each night. Miscellaneous small tools and parts, and even a small motor taken from a piece of office machinery, had made their getaway under the derby hat, while a company guard had admired its owner's erect posture as he left the plant.

The years have passed. Both shops are still in business; the first shop still has its reputation and is still an "open" shop, and its employees have at no time expressed a desire to unionize, although many of them carry a card. On the other hand, the shop at the opposite end of town has been the scene of several bitter strikes and is "closed." The story goes that should another strike rear its head, the plant will close forever. The stockholders are getting tired of passed dividends.

The moral is plain. The foreman, or management, in the larger sense, will find it good policy to grant a few simple concessions for employee welfare, for they will pay for themselves many times over in employee good will and loyalty.

Robert S. Alexander
Greenville, R. I.

•

I think it is wishful thinking on Al's part to say that setting a deadline for his men prior to quitting time will eventually achieve greater production. Was not the original quitting time just as much of a deadline?

There are hundreds of plants with such a practice in force but it is not of the slightest use in getting men to go all out and give their best efforts right up to the zero hour.

If men were even given a half hour in which to put their tools away and to clean up they still would slacken their pace before that half

hour. Human nature can't be changed, and it is one man in a million who works right up to the whistle.

Shop discipline varies greatly but in most cases men are influenced more by the example set by their supervisors than anything else. I think you will find them working right up to the sounding of the bell if they see their top man doing the same. Just watch a new man. At the start, he will work from the first minute right up to the very last minute but if he sees the other men doing differently he will fall into line before very long.

It is quite all right for Al to try anything that he feels will increase production and at the same time give his men a break, but it is up to him to set the example. Rules are no good unless everyone lives up to them.

Arthur Silvester
Niantic, Conn.

•

Observations in various shops have shown that some men ease off on their work regularly, if not closely watched, from ten to fifteen minutes before the end of the work day, while others ease off at points somewhat later, and some work faithfully up to the end of the day. Since they are all paid for a full day's work, is it not reasonable that they should all give the full day's work?

From the employers' standpoint, the pay must be at a point that takes care of the average; therefore the faithful worker earns more than his salary and the others receive something more than is their due.

Where there is a particularly dirty line of work in some departments, it would seem reasonable that the men so employed should be allowed a stated amount of clean-up time without loss of pay.

Anything that can be done near the end of the work day that does not interfere with production, such as putting away tools, etc., should be allowed, but in fairness to all the men who are paid for full production up to the end of the day, there is no plausible excuse for not giving their full time to the job.

John Mark May
Watervliet, N. Y.

•

BOSS AND BUST?

A man may not be a fool just because he passes up a foreman's job. Today in many plants the foreman is "the forgotten man." He is considered an enemy and a tool of management by the workers and only a necessary evil by management. He

OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS

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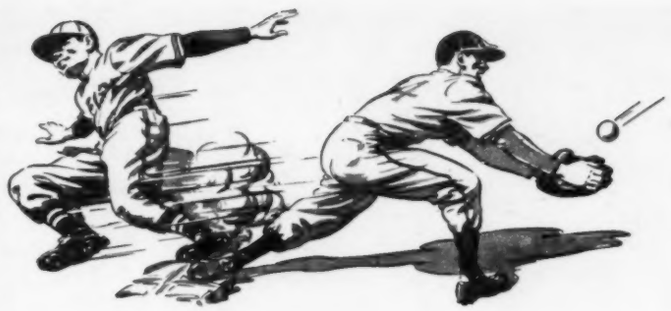
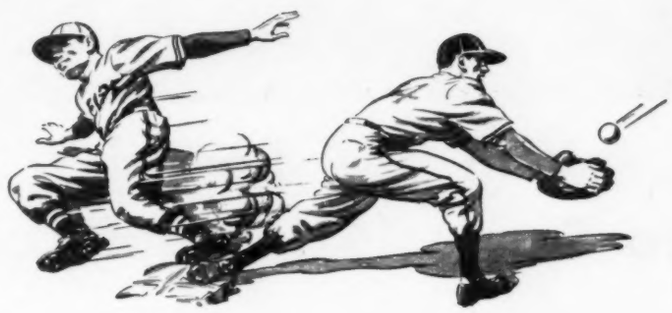


"STEELS" that repeat themselves



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Will You Spend $1 to Save $15 in Tool Costs

Three manufacturers recently completed thorough studies of the savings to be made in their plants through the use of a modern tool control system. The results amazed them!

One plant operates several tool cribs. Their engineers reported that an investment of about $5000 would save $73,000 the first year of operation. They recommended McCaskey Tool Crib Control. They actually saved more than $90,000.

The engineers of the second plant reported annual purchases of small tools and possible annual savings that opened the eyes of their management. They recommended McCaskey Tool Control for three cribs.

Savings of $65,000 on a tool investment of $500,000 were reported in the third plant. The engineers again recommended McCaskey Tool Crib Control to do the job.

Each of these plants has a world-wide reputation for alert production management. They have invested millions in modern production equipment but overlooked economies from adequate control of tools.

Facts from the results of numerous users prove that large savings can be made in practically every plant loaning tools to employees. They represent widely varying requirements . . . plants employing from as few as 50 or 75 to fifty thousand or more and operating one or many tool cribs.

Let us have a representative explain how McCaskey will pay its way from the beginning in your plant . . . or send *you proof of savings* in several well-known plants.

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gets the blame for everything that goes wrong in his department, but has not the authority to correct anything. The personnel department hires his help, the planning department decides how and where the work shall be done, the production department decides when the work shall be done, the workers select the jobs on the basis of seniority, and the inspection department decides if the work is correct. The foreman has just become an errand boy for the many people who run his department.

Not all men are ambitious to get ahead. Men like Dawson who enjoy their work and do a good job are assets to a company. Too many men today have ambition, but no qualifications for the job to which they aspire. Management should be thankful for the Dawsons and should reward them financially, where unions do not prevent rewards to men who deserve them.

C. A. Johnson
Springfield, Mass.

•

Ed's experience in having his man Dawson refuse to accept promotion can be matched by many of us. Those of us who like responsibility are prone to feel that all men are cast in our mold. That is far from true. It is a good thing, for if everyone wanted the boss's job there would be no one left to do the actual work. It is a mistake to take a first-class worker and bring pressure to bear on him to accept a supervisory position against his will.

Once I had an outstanding sheet-metal man who could easily outwork the next best three men in the department. When I offered him the job of foreman of his department, he was not anxious to accept. His reasons were: As a foreman he would be on a salary and expected to work overtime during the week and Sundays without extra pay; therefore, in the long run his job as foreman would pay less per hour. He didn't believe he could get the same results out of the many as he could out of the few under his immediate eye. As a foreman he'd have to tell the men they were soldiering on the job and thus become unpopular.

I talked this man into accepting the foremanship, however, and he set to work immediately and functionalized the work. The men objected bitterly. They liked the idea of making a job from start to finish, even if it took five times as long to do it; they now felt they had nothing in which they might take pride. The new foreman, also, although the

best man at bench or in the field, and the best individual worker in the whole plant, was not the best man to get work out of a hundred men, and that was his job. He was not popular.

The end result: The man was fired. Since then I have learned that it is usually a bad mistake to assume that the best mechanic will make the best foreman. He may be entirely lacking in tact and may not have the haziest idea of how to accept responsibility, and thus be deficient in most of the essential qualifications a supervisor should have.

James K. Matter
Detroit, Mich.

British Tests Indicate Superiority of Rolled Threads

Recent research in the field of thread rolling, as reported by W. A. Hawkins, Associate Editor of *The Machinist*, of London, indicates that the system has certain advantages over cutting methods, aside from the inherent speed of production. These advantages stem from the distortion that the material undergoes during working.

Cold working is responsible for an increase in both hardness and tensile strength, which naturally go together. Low-carbon test pieces of the same size, form and composition were compared in tensile and bending tests. The rolled thread had an ultimate tensile strength about 6% above that of a ground thread, and this figure was higher in comparison to lathe-cut and milled threads. However, the rolled thread was bent in a 160° arc that had eight times the radius of the 180° arcs of the cut threads. Thus, the increase in strength was balanced by a loss in bending properties.

Further tests showed that the increase in fatigue resistance of rolled threads averaged about 50%. An aging treatment at 250°C and repeated fatigue tests indicated that the loss of strength in the rolled sample was only about 75% of that in cut threads.

Fatigue tests on high-tensile-strength steels showed an increase of 40% in the limiting stress range of the rolled product over the cut threads.

The greater hardness of rolled threads alone is not enough to account for this superior performance. A contributing factor is the grain flow of the material parallel to the contour of the thread. Stress concentrations, such as are common in

OUT OUR WAY
HELP HIM THERE--I'LL GET TH'--A STRETCHER--NO, I MEAN--I'LL GET SOMETHING!
FUNNIEST FALL I EVER SEEN--BOY, I FEEL SORRY FOR TH' POOR SWEEPER!
YES, SIR! FIRST TIME HE FORGOT TO PUT DOWN SOL-SPEEDI-DRI--AND LOOK WHAT HAPPENED!
J.R.WILLIAMS
THE FALL OF THE YEAR
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SOL-SPEEDI-DRI is industry's No. 1 absorbent for all liquids. Spread over dangerous, oil-soaked floors, it provides a slip-proof carpet—cuts down on accidents caused by slips and falls. More SOL-SPEEDI-DRI is used in plants and shops all over the country than any other product of similar nature. The reason? There are many, but the big one is *quality*—constant, unvarying quality from one pound of SOL-SPEEDI-DRI to the next.

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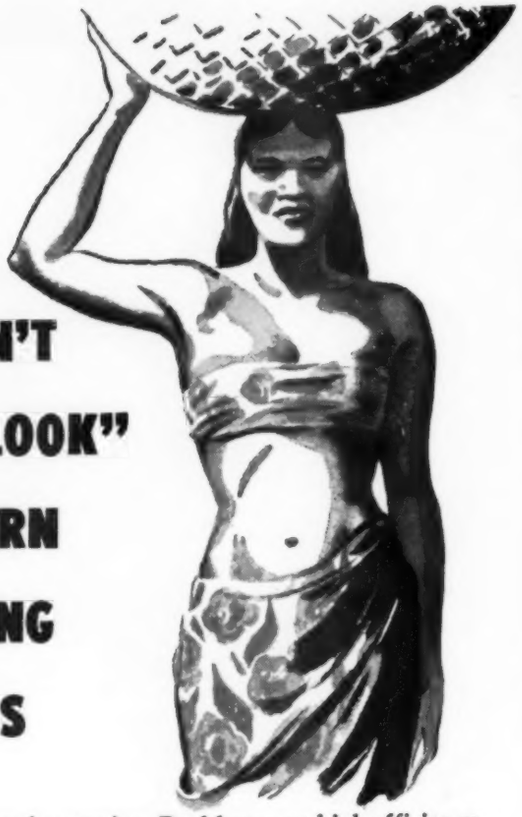

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cut threads, are considerably reduced in rolling. The smooth finish of the thread surface is another factor. This is produced by the slip between the dies and the work during production. An additional contributing factor is the residual compressive stress set up by the cold working under pressure. This stress, formed in the thread during cold working, must be overcome by an externally caused tensile stress before a resultant tensile stress—the nearly invariable cause of fatigue failure—can develop.

Just as hardness has little relation to machinability, it is fairly independent of rollability. The tests show that a rollable material must have good reduction and elongation qualities. In a materials test, both tensile strength and hardness of a nickel-chrome steel were greater after rolling than those qualities in a manganese-molybdenum steel. The latter steel was known to have been hard on dies. Micronanalysis of the steels in cross-section indicated that the manganese-molybdenum steel was distorted at its surface to a lesser depth than the other, although this distortion was greater in magnitude.

NEW BOOKS

APPRENTICESHIP REVITALIZED — *By Edward E. Goshen, Assistant Director, Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, D. C. Free* — An 8-page illustrated article describing apprenticeship programs for the railroad industry as exemplified by the programs of the New York Central and Union Pacific.

•

QUALITY CONTROL METHODS — *By Clifford W. Kennedy, quality control engineer, Federal Products Corporation, Providence, R. I. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y. 243 pages. Price $4.75.*

This book is written for those who are seeking a basic knowledge of statistical methods in quality control. The author recognizes their need for elementary information and explains fundamental concepts before proceeding to more involved techniques.

The limitations as well as the advantages of each method are pointed out and the importance of applying the technique only to the extent that

it produces actual value is stressed. Written from a practical viewpoint the book relates theory to practice and will appeal to personnel in the manufacturing divisions.

Major sections are devoted to acceptance sampling, batch control-percent defective methods, distributions and the standard deviation, average and range, and guide to administration of methods. Numerous charts and examples are presented to good advantage.

•

TECHNICAL DESCRIPTIVE GEOMETRY—*By B. Leighton Wellman, head, Div. Engrg. Dwg., Worcester Polytechnic Institute. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N. Y. 508 pages, 6x9 in. Price $4.*

Here, for the first time in our experience, is a "descrip" book that doesn't ask the student to imagine planes and projections. Reference lines are not spatial, but simply aid construction of additional views. The book begins with extremely simple concepts, progresses to complex intersection and development problems, including compound-curved surfaces.

"Descrip" has been traditionally the course which the imaginative student understood, the unimaginative one failed utterly. This new approach should be the salvation of the latter group, for it requires no visualization, but rather logical reasoning.

The book is extensively illustrated, contains ten chapters of instructional material plus an eleventh chapter of 1,568 problems. It is primarily a college text, but can also serve the working industrial designer.

TO THE EDITOR

There is a grave discrepancy in the article, "Toolslide Set at Angle Makes Accurate Turning and Boring," in the June 3 *Practical Ideas* department.

If the compound slide is set to an angle of 11 deg., 32 min., 13 sec., a slide movement of 0.001 in. will cause a change in the diameter of the work of 0.0004 in., not, as the article states, 0.0001 in.

If the slide is set to only 2 deg., 51 min., 57.9 sec., a 0.001 shift in the slide will produce a 0.0001-in. change in the diameter, or 0.00005-in. change in the radius.

Unless the slide has a vernier,

Compound blanking and piercing die . . . machined to tolerances of ± 0.001" in "HSC 265" air hardening alloy steel . . . preferred for its superior wearing qualities, its unusual resistance to warping and distortion in heat treating.

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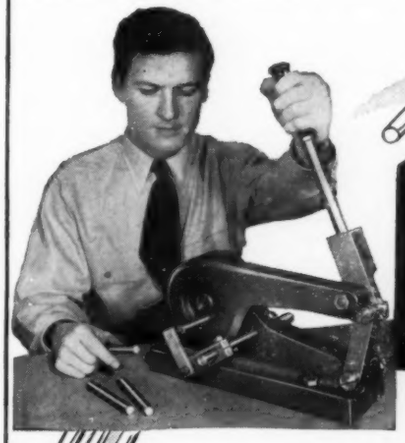

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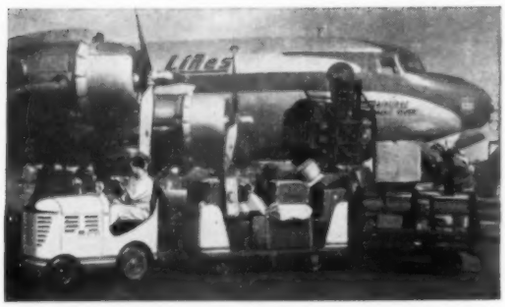
MATERIAL HANDLING News

This compact package of pulling power "delivers the goods," at low cost The CLARKAT



Trailer-loads of luggage, mail and express are hauled swiftly by the Clarkat to a waiting air liner.

On their way to storage a Clarkat hauls trailers loaded with castings, machined parts, drums and miscellaneous items.

Mass handling of palletized units on trailers is an easy, natural job for the Clarkat.

Thorough, thoughtful analysis of performance records of towing tractors used in Industry leads you inevitably to the husky, nimble Clarkat.

Hauling huge tonnages of material by the trailer-trainload—using its squared nose to bulldoze heavy units into position—handling the numerous heavy-pull jobs common to most busy plants: the Clarkat has made an extraordinary record for efficient and economical performance wherever it has been put in service.

Only an experience like Clark's—30-odd years of resourcefulness in evolving modern materials handling methods and machines—could produce the Clarkat.

Exceedingly important is the exclusive and flexible center-pivoted suspension of the full-width steering axle—a guarantee of smooth, safe travel over rough surfaces. It's easy to handle, easy on the driver, easy to steer.

It is built in two models:

- Clarkat "20"—drawbar pull 2000 pounds, towing capacity 42 tons
- Clarkat "26"—drawbar pull 2600 pounds, towing capacity 58 tons

It is gas-powered, with either solid or pneumatic tires. For still heavier hauling the Clarktor "6" is recommended; built in four models with towing capacities of 47, 68, 90 and 104 tons respectively.

A knowledge of this husky, hustling worker rates high as vital business information. To explore how it will speed up your production with substantial savings, get the objective survey and recommendation of a Clark field representative.

It's always "good business" to CONSULT CLARK.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

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REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

there may be some difficulty in obtaining this angle with great accuracy. The feed graduations are quite accurate and may be depended upon if there is not too much lost motion between the screw and nut. It is hoped that there will be some real use for this data, because it is quite often of value to know about these kinks. *W. Wallace Boyd, Mechanical Engineer, Glen Ridge, N. J.*

"Quotes"

Research Included Among Future Developments in Materials Handling

SPEAKING in connection with General Electric's More Power to America program on "Materials Handling in Receiving, Shipping and Warehousing," J. R. Kilander (materials handling expert of G. E.'s Apparatus Department Manufacturing Division) outlined paths along which new advances may be made and issued a call for research in materials handling.

"One of the reasons industry as a whole has advanced to its present high standard is because of research. Why not a complete research building or institute for materials handling? Then actual machines could be set up, tractor trains brought in, conveyors installed, ramps built and storage areas planned to make sure the most effective technique and equipment are used. It would be well worth the cost. The time may come, gentlemen, when we may enjoy the results of such a research program to solve many of our problems."

Referring to other possible developments Mr. Kilander said: "I think it safe to predict that some day pallets will flow as freely between shippers as boxcars do, and interstate, inter-company, and inter-department boundary-barriers will be eliminated. Expendable or more durable pallets may provide an answer, also, to some of these problems.

"Since materials handling is at once pure overhead and an indispensable part of any company's operations, the obvious thing to do is to keep its cost as low as possible through the use of the most modern equipment available.

"Materials-handling engineers in plants or companies of any size at all have faced the problem of equipment in one section of the plant being

rushed while equipment in another section is idle. In some cases this means keeping a much larger truck force than necessary, just to accommodate these chance peak loads. One solution may be the use of short-wave radio on trucks, tractor trains, etc., so they may be summoned to one spot quickly.

"Many of these materials-handling problems, also, might be solved through the effective application of time and motion studies to materials handling problems, with the same degree of intensity that they are to other manufacturing operations. No one quite knows what the savings might be if this were done, because it has never been tried to any great extent. But in those cases where it has, the results have been well worth the trouble and expense. The integration of materials handling into plant layout, through the use of scale models in the preliminary stage, has produced results well known to everyone in the field."

•

Selling Labor on Increased Productivity

CHARLES LUCKMAN (President, Lever Brothers) in an address before the 25th General Management Conference of the American Management Association, emphasized that "our job now is to figure out new ways of restoring the basic idea of increased productivity to a place of dignity and respect in the eyes of the people who man our machines."

"We (management) know that we can't expect a healthy economy by sweating labor and cutting wages. They (labor) have got to learn that it is equally impossible for them to expect a healthy economy by freezing output and raising wages. The theory of more pay for less work is just as stupid as the theory of less pay for more work. What both groups really face is a challenge to get together, to drop the name-calling and to devise a plan which will produce both more pay and more work.

"This type of productivity planning raises some questions of principle. Two in particular warrant mention here. The first and most important principle in any plan for increased productivity is to insist that it be the *joint* product of employer and employee thinking. If there is any place in the industrial process where the concept of partnership has validity, this is it."

Expanding this principle, Mr. Luckman said, in part, "Since it is natural for Americans to take pride in their work, the greatest crime

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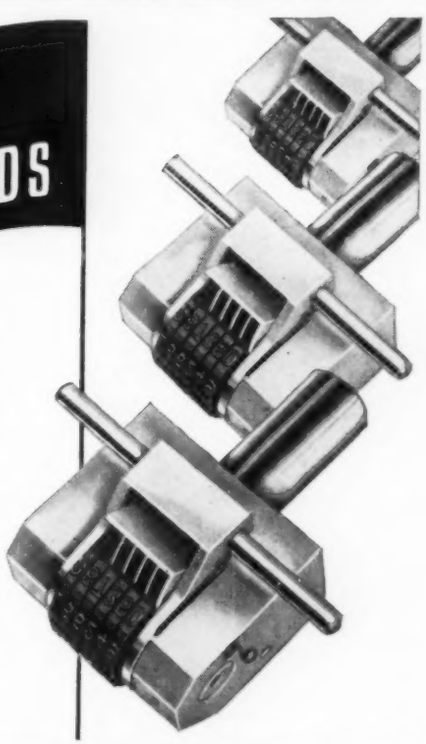

Noblewest automatic numbering heads are guaranteed to be the finest obtainable. Produced from specially selected steel, every part is precision made by master craftsmen in a plant equipped with every modern tool-making facility. Standard models are available in any size numbers from 1/40" to ½". Special numbering heads are made to any requirements including embossing heads, and numbering heads combined with dies. Write to Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

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Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

No. 55

For rounding, pointing, chamfering or burring external and internal:

spur gears
helical gears
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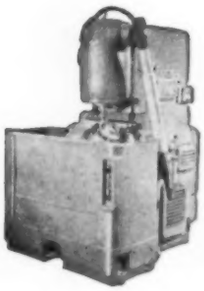
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.



No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
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Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

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that either industry or labor can commit—whether by design or neglect—is to corrode this American instinct to do a good job and to take pride in the job well done. The drive to achieve can be created only by freely accepting men as equals in the productive process and by challenging their creative energies and technical skills. We can no longer bar men from a voice in planning their own affairs and still expect them to exclaim with delight over our concept of what is good for them. Labor should not be an antagonist but a partner in the common search for higher productivity.

"My second basic premise is that labor shall be permitted to share fairly in the fruits of its increased productivity. Justice in dividing those fruits is not only a matter of morals. It is also a matter of low-down expediency. This means that the worker's incentive pay should be at least in direct proportion to his extra efforts."

•

Injection-Molding Advances

GEORGE W. WHITEHEAD, Improved Paper Machinery Corp., traced the 15-year development of injection molding at the 1948 annual meeting of the Society of the Plastics Industry:

"The first advance was achieved through a demand to produce more pieces per cycle. This called upon the machinery maker to produce a larger machine—one having more plasticizing capacity, greater clamping tonnage and greater die space. As a result, we can trace the development of the 4-oz., 6-oz. and 8-oz. machines. In keeping pace with this machine advancement, we find the molders developing new jobs by selling the industrial field on plastic applications.

"With these machines at their service, the molders have proceeded with confidence. They have sold their ability to mold large pieces to their customers.

"Up to this stage in the growth of injection molding large pieces it has not been an art, but rather a determined onward march with millions of dollars spent in tools, materials and engineering brains.

"It will be interesting to see what another ten or fifteen years will bring. . . . . there will be large machines, there will be bigger molds, there will be improved and even new materials, and there will still be molders willing to produce pieces larger than we have today, perhaps whole refrigerators, kitchen sinks and bathtubs."

These Men Will Tell You

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Says JOSEPH DIETZ
General foreman of Republic Flow Meters Co., Chicago: "Ideal Live Centers give us greater turning speed and have helped increase production 15% to 25%. They save both grinding time and lubricating time."

Says FRED HUER
Machinist at Republic plant: "Ideal Live Centers improve the quality of the work. They eliminate chatter, center lubrication, and burned out centers."

In scores of plants the story is the same: Ideal Live Centers mean better work at lower cost. No friction between the center and the work—no burning or gouging—deeper cuts and faster turning speeds. Ask for information and free demonstration.

Ideal Male type Live Center. Female and Pipe type Centers also available from stock.

Also Heavy Duty Live Center—built to carry heavy loads. Accurate to .0005.

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UNDIVIDED RESPONSIBILITY . . . Experienced engineering — precision helical gears — liberal ball bearings — splash lubrication — and rugged construction are combined in this one compact, sturdy, dependable unit.

Improved Sterling Slo-Speed geared motors are available with single and double reduction gears in a wide variety of ratios.

Use the improved Sterling Speed-Trol—where "speed control" — faster or slower — is required.

Where constant normal speed is required, use the Improved Sterling KLOSD; KLOSD-TITE FAN-COOLED; KLOSD-TITE ENCLOSED; KLOSD - FACE - MOUNTED electric power drives.

STERLING ELECTRIC MOTORS

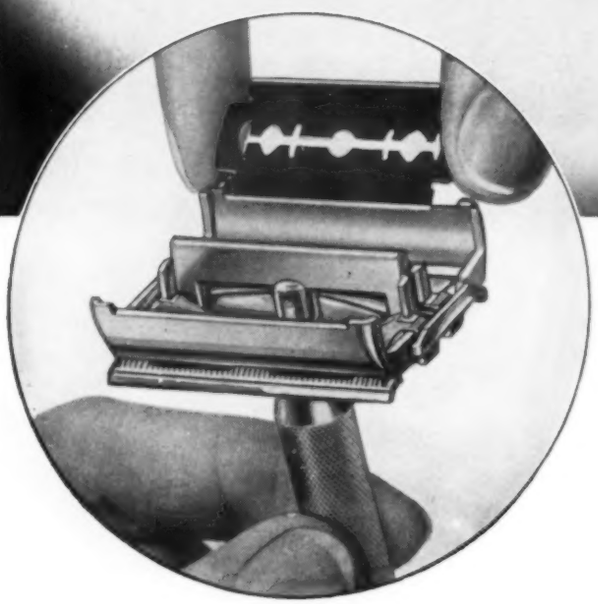
GENERAL OFFICES: LOS ANGELES 22, CALIFORNIA

New York 7 • Chicago 6 • Detroit 2 • San Francisco 5 • Philadelphia 7 • Boston 9
Seattle 4 • Cleveland 15 • Buffalo 3 • Pittsburgh • Cincinnati 2 • Atlanta 3 • St. Louis 8
Houston • Milwaukee 2 • Baltimore 2 • Memphis • Kansas City 2 • Dallas 1 • New Orleans 13 • Minneapolis 15

Canadian Sterling Electric, Ltd., Hamilton, Ontario, Canada

Representatives in Principal Cities and Foreign Countries

HARDINGE
ELMIRA, N.Y.



HARDINGE

Master Feed Fingers and Pads

You wouldn't throw away your good SAFETY RAZOR — because of a dull blade. Then why use old-type solid, breakable and costly feed fingers on automatics when.... HARDINGE style "B" MASTER FEED FINGERS with replaceable pads will save 30% to 80%.

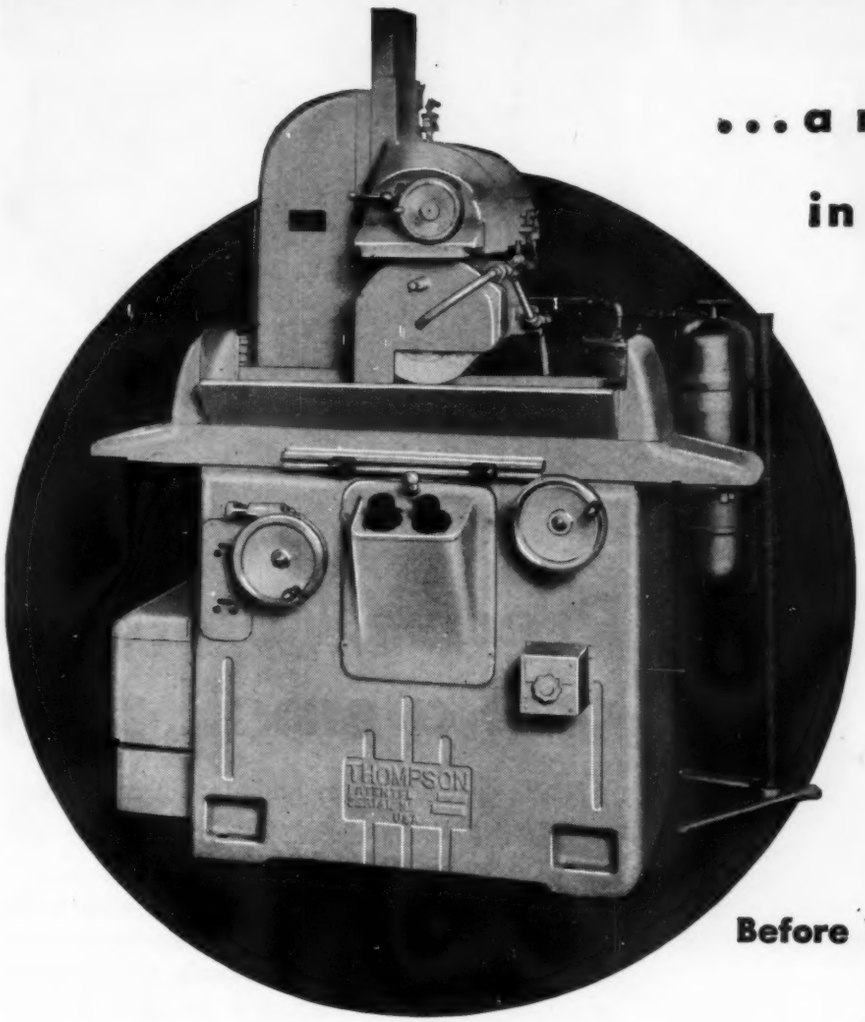
For Brown & Sharpe, Cleveland, Cone, Davenport, Greenlee, Gridley, Acme-Gridley, National Acme, New Britain, and New Britain-Gridley Automatic Screw Machines.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

COOLANT THROUGH WHEEL

GREATLY IMPROVES GRINDING METHODS



...a new development in surface grinding by THOMPSON

Now you can grind very thin sections without burning and warpage.

Before You Buy

Investigate

Thompson provides a full range of machine sizes from 6" x 18" to 36" x 240" utilizing the new principle of applying coolant to the grinding wheel. The new Thompson Type "F" Hydraulic Surface Grinder with coolant through the wheel is shown above. All of the coolant is applied through the grinding wheel, making it possible to grind exceedingly thin sections without burning or warping the work.

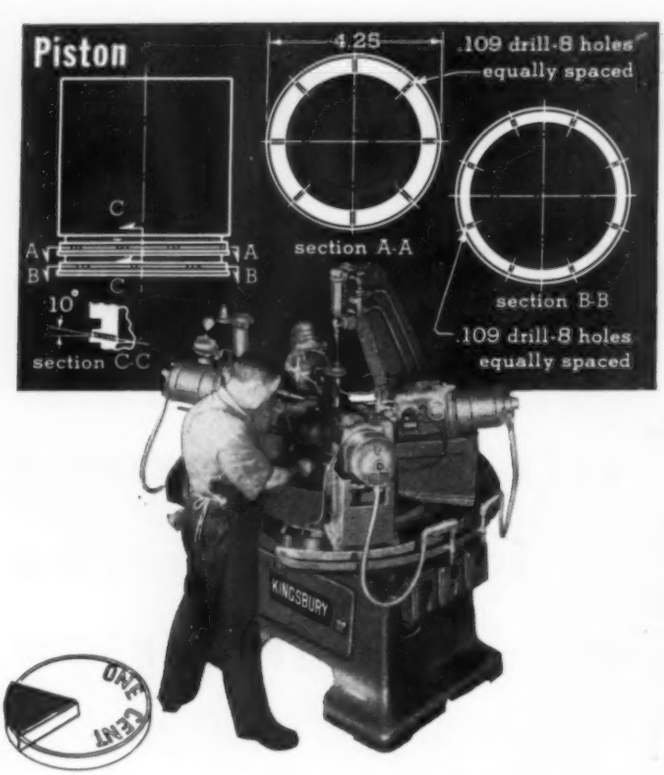
Very fine finishes are obtained to extremely close dimensions. An outstanding advantage of this patented process is gained in grinding blanking dies and other metal cutting or shearing tools. No amorphus metal is present after grinding. This increases the life of the tool between grinds.

Thompson SURFACE Grinders

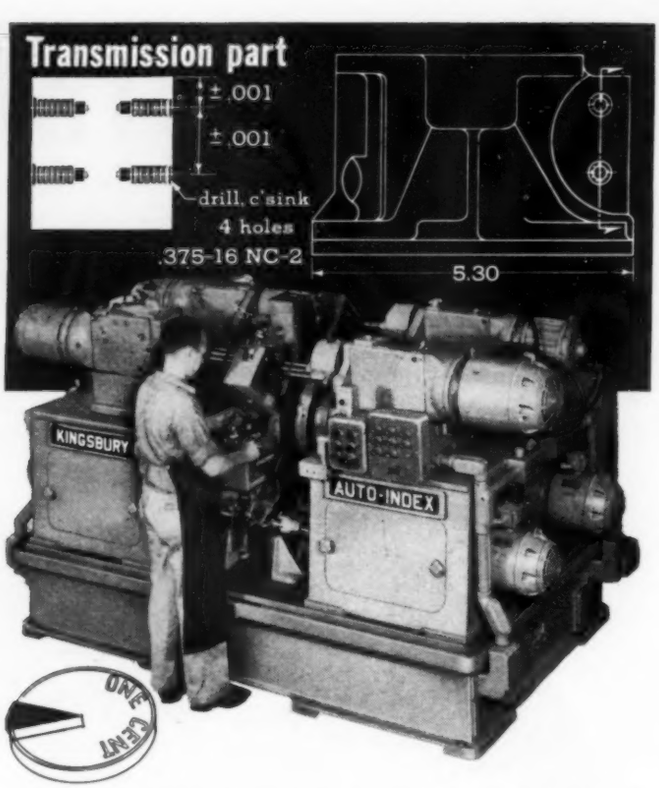
WRITE TODAY **for details of this new process and for information on ways it can save you production time and money! Address Dept. 10, The Thompson Grinder Company, Springfield, Ohio.**

SEND FOR NEW 32-PAGE GENERAL CATALOG

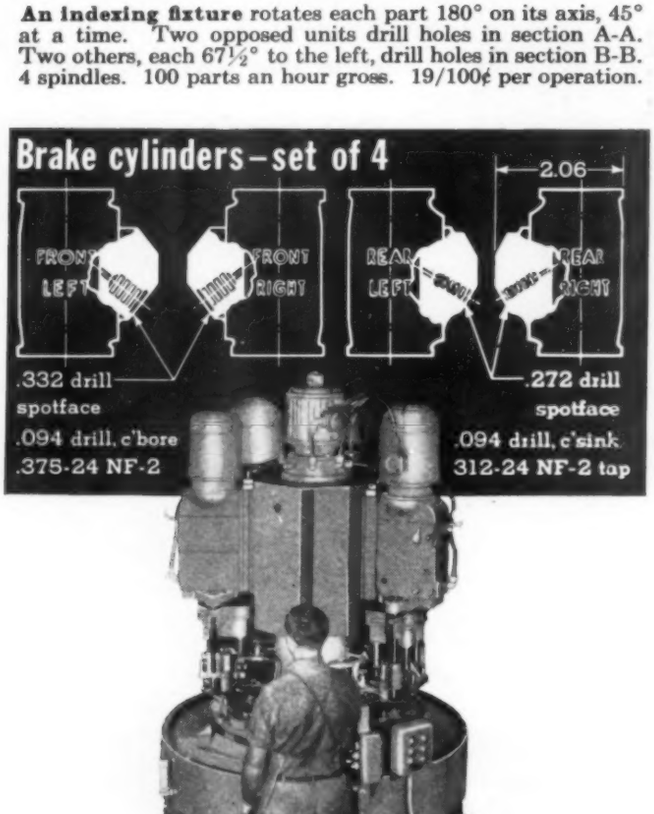
Copyright 1948—The Thompson Grinder Company



An indexing fixture rotates each part 180° on its axis, 45° at a time. Two opposed units drill holes in section A-A. Two others, each 67½° to the left, drill holes in section B-B. 4 spindles. 100 parts an hour gross. 19/100¢ per operation.



A vertical indexing machine enables 4 pairs of opposed units to operate in sequence on each part. Bushings guide the drills and the bushing carriers pilot onto the fixtures. 16 spindles. 537 parts an hour gross. 10/100¢ per operation.



A horizontal indexing machine with central column has 7 duplicate fixtures that hold all 4 parts. Vertical units with 4-spindle auxiliary heads do the 5 operations in sequence. 20 spindles. 266 sets an hour gross. 18/100¢ per operation.

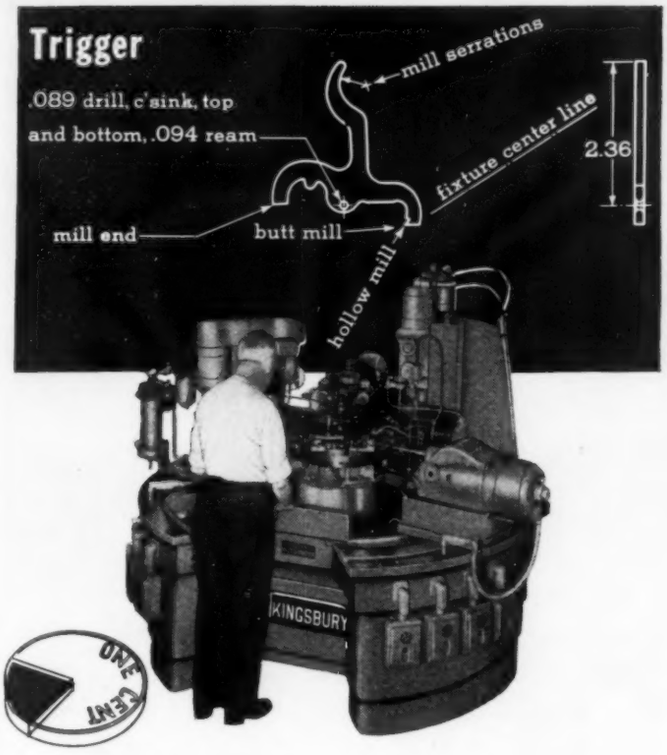
Precise, uniform cost a small part

All 6 of these machines are basically different. Some do simple jobs, others solve complex problems. Yet all have these features in common:

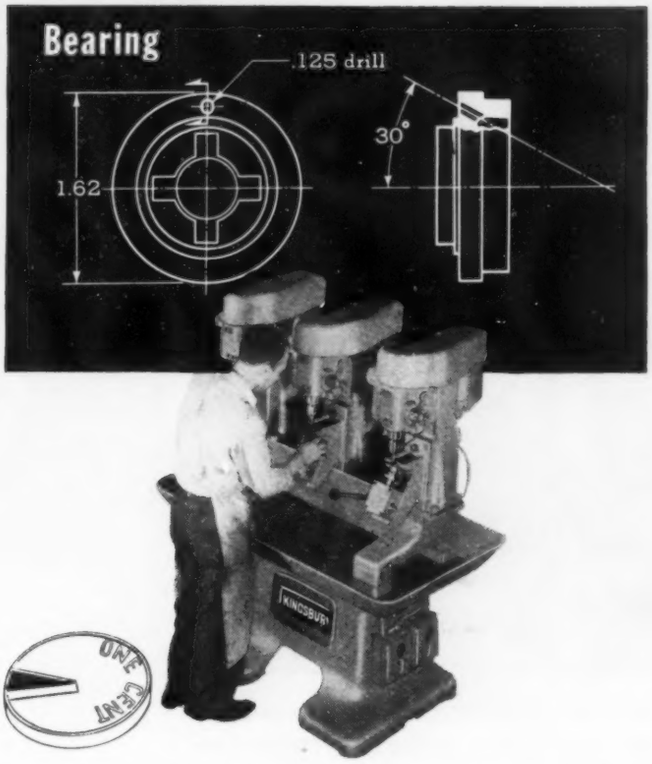
Low cost. The blue segment of each penny is the cost per tool per part of the machine *plus* the operator. We assumed the machine would run at 80% efficiency for only 6000 hours (a fraction of its useful life) and we figured on a generous wage rate. No power or overhead. The average for these 6 machines is 16/100 of 1 cent per tool per part.

Efficient use of standard equipment. We build 12 standard automatic drilling and tapping units (max. 5 hp), 82 standard attachments, 8 standard index units and 18 standard bases. Our top men study and discuss ways to apply this equipment until they agree on a practical solution.

KINGSBURY



A horizontal indexing machine has 3 horizontal units that work from 3 directions. All are off the radial lines; one mills on the backstroke. Vertical units complete the part. 6 spindles. 315 parts an hour gross. 22/100¢ per operation.



A vertical machine has 3 separate units and 3 fixtures. The operator changes parts in the fixtures and trips the units, one after the other. The work cycle in each unit is automatic. 3 spindles. 1060 parts an hour gross. 8/100¢ per operation.

operations here of a penny each

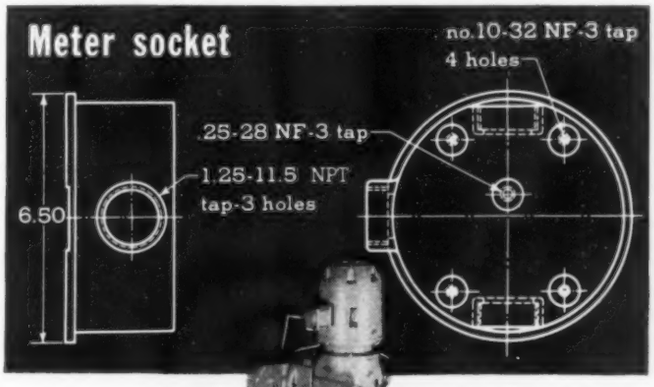
Uniform product. Automatic work cycles never vary. Fixtures that index are indentical duplicates.

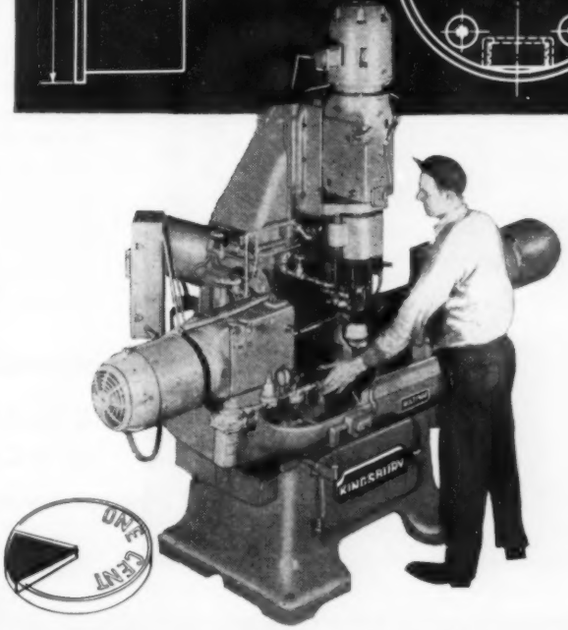
Accurate location of operations. Fixtures hold the work rigidly until after the last operation. Bushings guide drills and reamers.

Operate efficiently for years. Alloy steel wear parts, hardened and ground. Gears induction-hardened and shaved. Normalized castings and weldments.

Experience. We have designed, built and tooled over 3400 machines like these. It is our sole business.

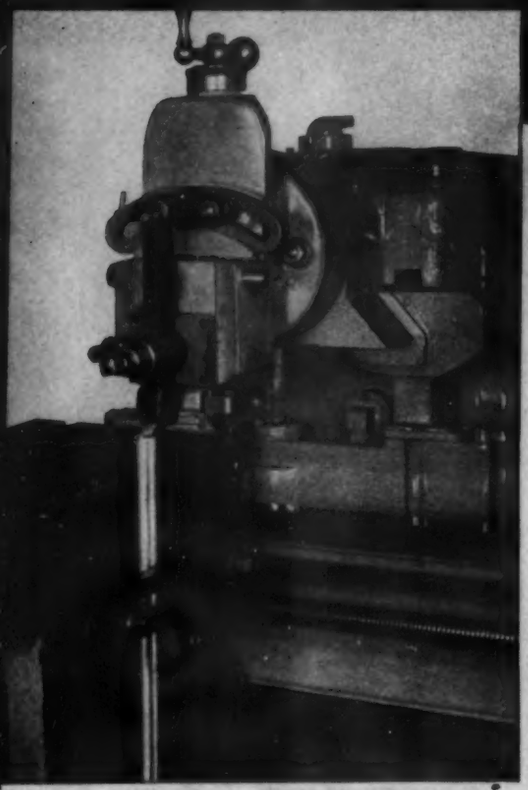
Proposals. If you have a high production job with operations like these, ask our Mr. L. A. Carll for a proposal on a tooled machine. Send him a print showing the operations and hourly output you need. Free bulletins show 40 setups. Kingsbury Machine Tool Corp., 30 Laurel St., Keene, N. H. 62



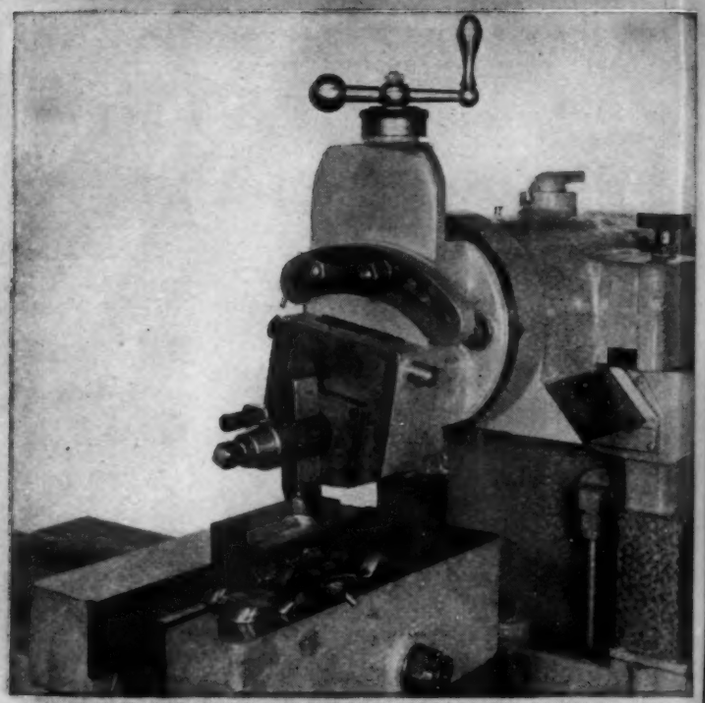


A multi-way non-index machine taps in 4 faces of each part at once. Clamping and unclamping is automatic. Operator merely unloads, loads and presses levers to start the cycle. 8 spindles. 266 parts an hour gross. 17/100¢ per operation.

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production



SHORT STROKE . . . slotting keyway in end of shaft. Extremely short cutting and return strokes may be set at high speeds . . . without causing vibration or affecting smoothness of cut. Adjustment for any speed or stroke length is made quickly and easily by a simple setting of stroke adjustment levers . . . an important advantage in small lot production.



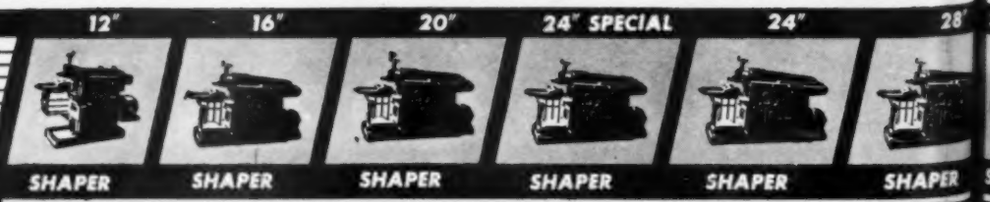
ROUGHING CUT . . . note size of chips. Rugged construction and abundant power make heavy-duty work an "every-day job" for a Rockford Hy-Draulic Shaper. Hy-Draulic design is also a safeguard against excessive feed and resultant overloading. The hydraulic system provides a predetermined maximum pressure, ample for every type of job; when an unsafe overload is met, ram will stop, as oil by-passes.

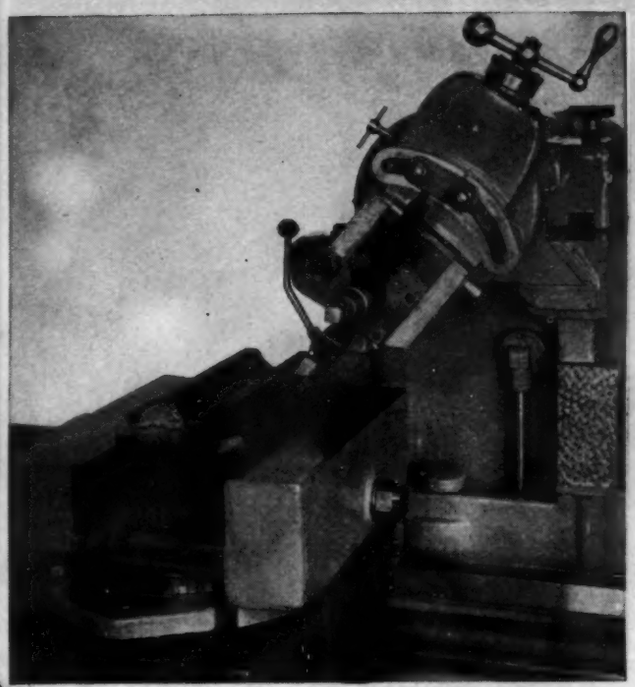
can you compete . . . ?

Why not make sure of your shaper equipment now. Ask yourself, could you compete with the work turned out on a new Rockford Hy-Draulic. Compare the work turned out on your present equipment with that of a champion in terms of cost, accuracy, operating ease or speed. Rockford Hy-Draulic Shapers give you accurate, infinite control of stroke and feed. They also give operating advantages that only Hy-Draulic design can provide. Put a Rockford Hy-Draulic Shaper through its paces and watch it perform on every type of shaper job. Write for Shaper Bulletin 442.

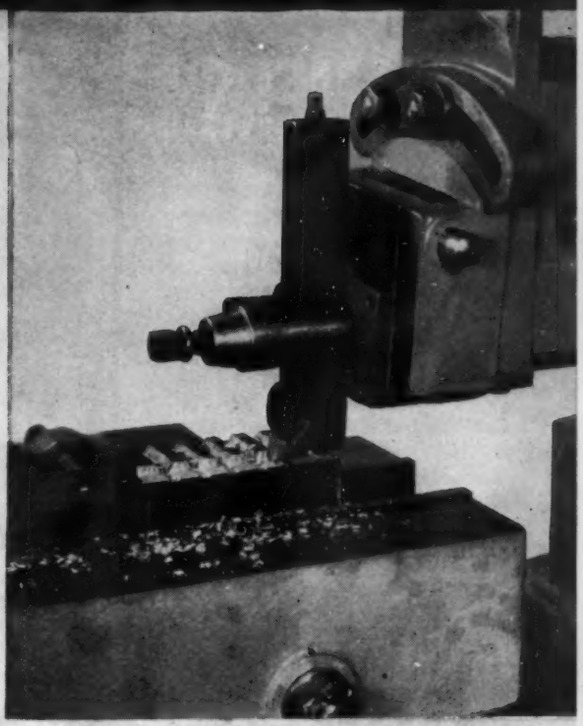
ROCKFORD MACHINE TOOL CO.
ROCKFORD ILLINOIS

Hy-Draulic

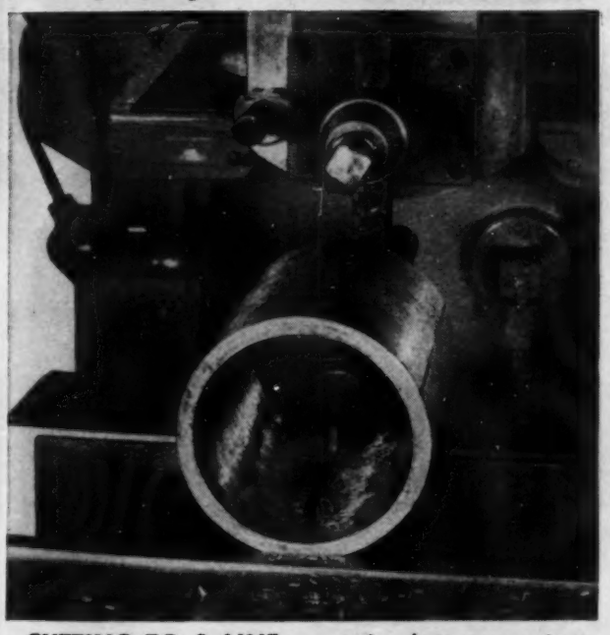




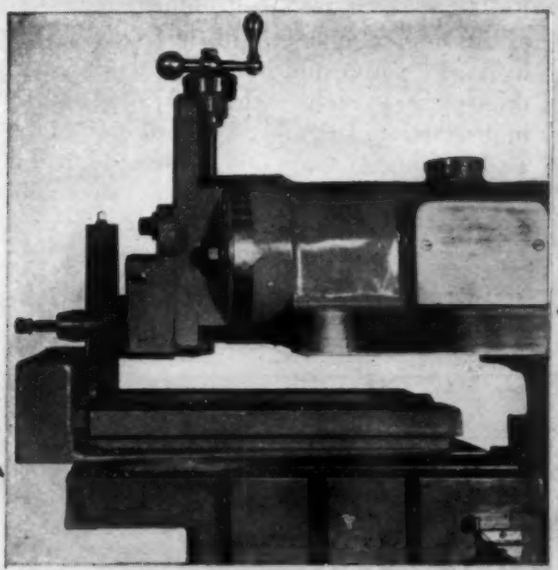
ANGLE CUT . . . cutting a dovetail on a slide. Precision of Rockford Hy-Draulic Shaper construction assures work accuracy and fine surface finish.



INTERMITTENT CUTTING . . . cushioning effect of hydraulic system makes interrupted cutting an easy operation for both tool and machine. Eliminates shock as tool enters each cut . . . protects tool against rapid wear and breakage.



CUTTING TO A LINE . . . cutting keyway up to a drilled hole. As in the preceding illustration, this work set-up is an example of the accuracy in stroke length maintained by the new Rockford Hy-Draulic Shapers.



CUTTING TO A SHOULDER . . . this illustrates ability of shaper to maintain stroke length exactly. Whatever the stroke length or speed, it can be demonstrated that the new Rockford Hy-Draulic Shapers will cut-to-a-line with an accuracy far greater than required by any conventional shaper set-up.

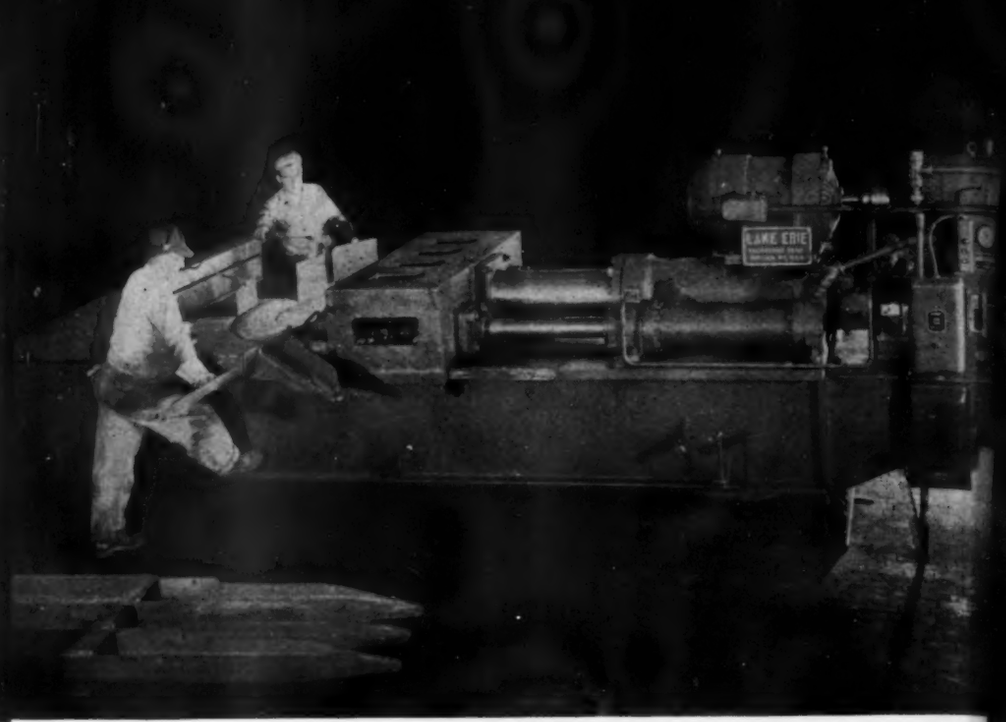
36" OPENSIDE PLANERS SLOTTERS SHAPER-PLANERS

Hy-Draulic

SHAPER

ALLIS-CHALMERS

OPERATE TWO Bulldozers in the Springfield Works bending and forming frame members and other parts. Six more Lake Erie Bulldozers serve other Allis-Chalmers plants. Quality and uniformity of parts is better when they are produced with a hydraulic "squeeze." Lake Erie Bulldozer frames are heavy welded sections. Deflection under load is negligible and close die alignment is assured at all times.



HYDRAULIC BULLDOZERS SPEED PRODUCTION IN LEADING PLANTS

Used for hot and cold bending and forming operations—dies cost less... time is saved on set-ups... pieces are easier to handle... worker safety is increased.

The number and type of plants installing Lake Erie Hydraulic Bulldozers is an excellent indication of the many advantages of this new equipment. This improved combination of flexible hydraulic power and horizontal working of parts is enabling these plants to realize substantial economies and improvements in production. Lake Erie Hydraulic Bulldozers are available in a wide range of types and sizes for both standard and special applications. Let us know your requirements and we'll suggest a Bulldozer suitable for your particular needs. No obligation.

LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

★

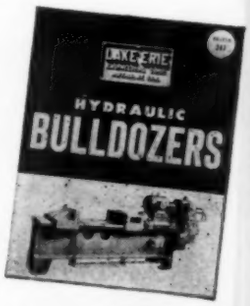
General Offices and Plant.

507 Woodward Avenue, Buffalo 17, New York

DISTRICT OFFICES IN NEW YORK, CHICAGO AND DETROIT

Representatives in Other Principal Cities in the United States and Foreign Countries

● Leading manufacturer of hydraulic presses—all sizes and types—metal working...plastics molding ...forging...metal extrusion...processing...rubber vulcanizing...stereotyping ...special purpose.

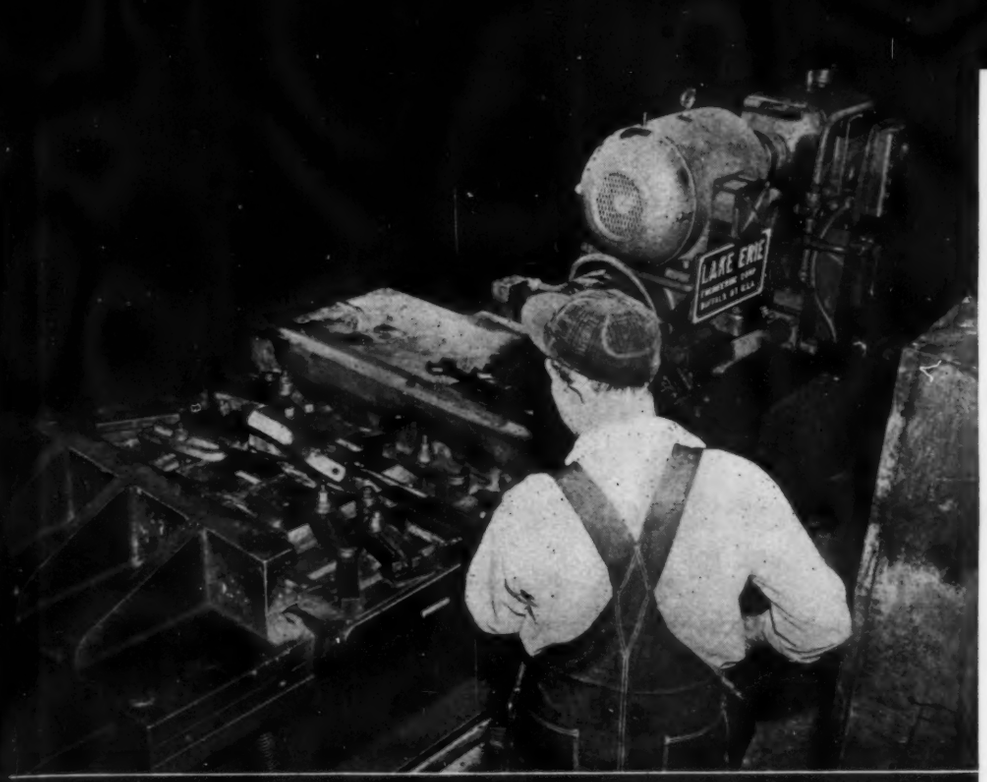


WRITE *for Bulldozer Bulletin* 507

Eliminate Production Shut-Downs Caused By Breakage Due To Overloading

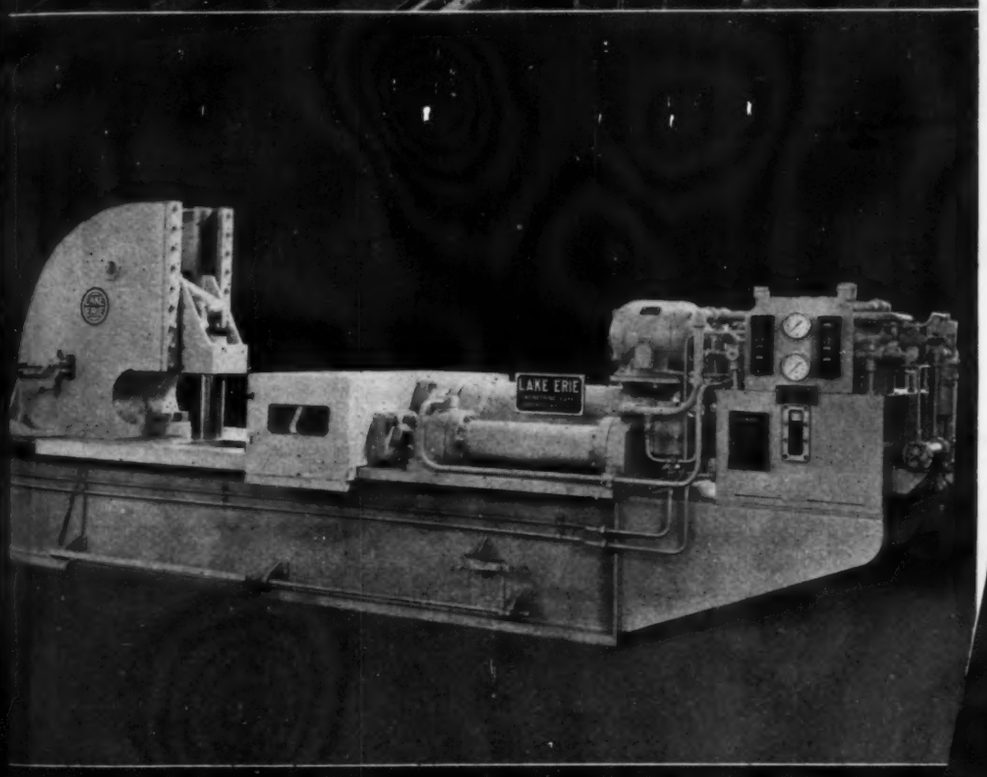
INTERNATIONAL HARVESTER

ALREADY HAVE two in operation producing main frames for mowers and rakes. Dies for Hydraulic Bulldozer use can be designed more simply and produced less expensively. Standard equipment on Lake Erie Hydraulic Bulldozers includes adjustable stroke stops, automatic adjustable pressure control on pumps, air and oil filters and pressure gages. Ways are hardened steel and are highly resistant to wear.



J. I. CASE CO.

HAVE THIS Lake Erie Bulldozer in their Racine plant. It is shown producing radius rod straps for tractors...one of its many production jobs. Any part of the stroke of a Lake Erie Bulldozer can be used with full pressure at any point. Hydraulic power and the control system employed simplify die set-up and change-over and eliminate the danger of breakage through overloading.



WESTINGHOUSE ELECTRIC

USE THIS standard model with both a standard head and a special ring forming head for producing motor frames. Lake Erie Hydraulic Bulldozers have double acting traverse cylinders that automatically speed the approach and return strokes and permit high rates of production. Lake Erie Bulldozers are compact, self-contained units that can be installed or moved if necesssary with a minimum of delay and expense.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

NORCOR

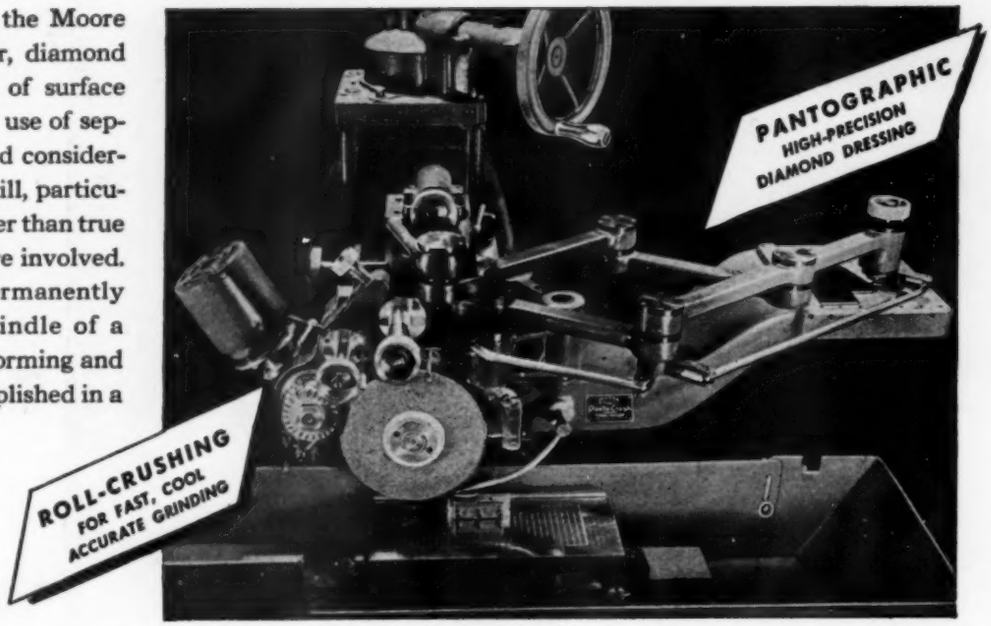
EMPLOY BOTH vertical and horizontal Bulldozers in the production of steel table frames and chair channels. Lake Erie Bulldozers are foot treadle operated. This leaves the operator's hands free to insert, adjust and remove work from the press. Pressure on treadle advances crosshead. Stroke can be stopped and returned at any point merely by releasing the treadle.

Now you can combine roll-crushing and diamond dressing in a single wheel dresser to speed form grinding

Before the development of the Moore Panto-Crush Wheel Dresser, diamond dressing and crush-forming of surface grinder wheels called for the use of separate devices. These required considerable set-up and operating skill, particularly where odd contours other than true radii and straight surfaces are involved.

Now with the Moore, permanently mounted on the wheel spindle of a surface grinder, both crush-forming and diamond-dressing are accomplished in a single mechanism.

Here's how this 2-in-1 machine does it:



1. Combines Pantograph, working directly from template, and *Roll-Crushing* in one device, accurately related to spindle.

2. Switches from one method to the other without disturbing workpiece setting or location of either trueing device.

3. No setting up of complex attachments each time wheel is dressed... no raising of wheel spindle from work to dress, yet wheel spindle may be raised or lowered without losing relation of wheel form to dressing device... crusher method saves diamond costs.

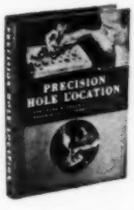
4. Assures highest roll-crushing accuracy and economy. Crusher roll is *ground* and *used* on same spindle, without disturbing position... no expensive machine required to grind crusher roll... no worry about hardening distortion, because roll is ground *in place* from the solid directly from template.

5. Takes Skill out of job, yet adds advantage of crush dressing for heavy cuts without heating work, and ultra-precision diamond dressing.

6. Device need not be removed to use machine as conventional surface grinder.

Both MACHINE DESIGN and MACHINERY magazines devoted considerable editorial space to technical discussions of the value of this ingenious new mechanism. We'll be glad to send you reprints and a descriptive catalogue on Panto-Crush.

MOORE SPECIAL TOOL CO., Inc.
738 UNION AVENUE, BRIDGEPORT 7, CONN.



HAVE YOU BOUGHT YOUR COPY OF "PRECISION HOLE LOCATION"?

Over 5,000 copies of this valuable book on toolmaking practices have been sold to date. Available at special price of $3 in U. S. A.; $3.50 outside U. S. A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.

Add a MOORE to YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS
DIE FLIPPERS · COMPLETE LINE OF HOLE LOCATION ACCESSORIES

When the blade gets the shave . . .

. . . the utmost in precision metal-removing is required.

Take for instance the Air Foil Rotor Blades that are such a vital part of a jet propulsion engine. The root forms of these dovetail, pine tree, and slotted type blades are being precision broached with Lapointe machines and broaches. That's because Lapointe's engineers have successfully tooled for the new tough alloys to give precision well within specifications and production possibilities far beyond present demands.

Leading manufacturers of reciprocating engines have for years depended upon Lapointe broaches and broaching machines for mass production and precision metal-removing. Naturally, these same manufacturers, plus many new ones, are turning to Lapointe now that the problems of jet engines are a reality. It is a brand new field, and Lapointe has been a part of it from the beginning.

If you are working on the new jet program, write to Lapointe, Dept. 69, today. You'll find Lapointe engineers ready to assist you in your metal-removing problems.

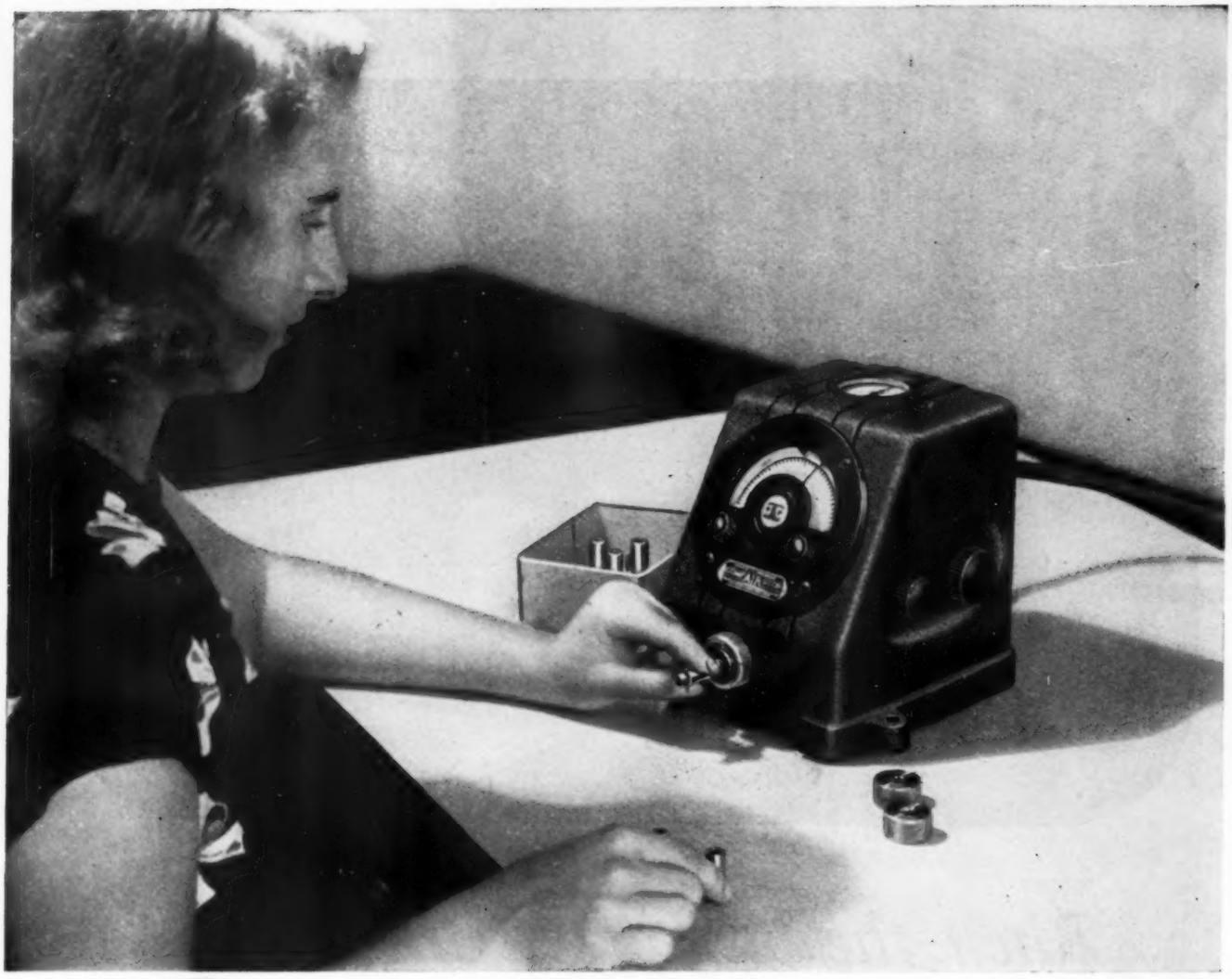
THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

HUDSON LAPOINTE MASS.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



Streamline **YOUR SMALL-PART INSPECTION . . .**

***with this rapid* TAFT-PEIRCE**

COMPAIRATOR

An unskilled operator can check small parts with great rapidity with this new Taft-Peirce air gage. No special skills are needed for *it measures without mechanical contact.* Taper, out-of-roundness, barrel shape, bell mouth and other dimensional variations are instantly indicated.

IT IS FAST. With the speed of a velocity-type air circuit it has the sensitivity and easy readability of a dial indicator.

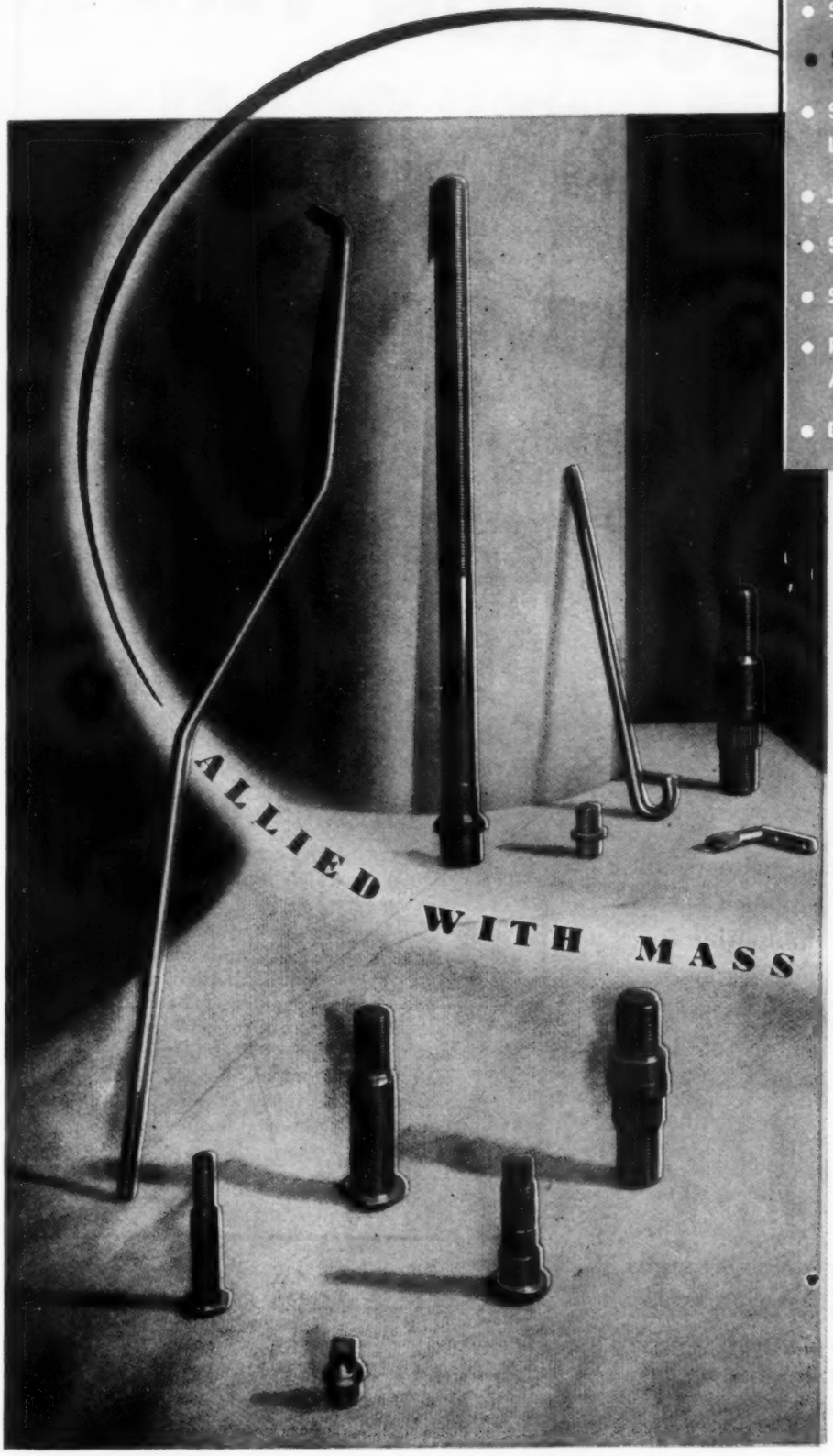
IT IS SMALL — only 7″ wide, 8½″ deep, 8″ high, with a weight of 12 pounds — and can be used wherever a suitable supply of air is available.

Without question, this new air gage is the answer to *faster* small-part inspection. (1) Anyone can use it; (2) It is fast; (3) It can be used right at the machine, at the bench, or in the inspection room, with any length of extension hose up to 20 ft.

So for information on quicker, *more economical* inspection of small parts get the bulletin on this new CompAIRator. Write: The Taft-Peirce Manufacturing Co., Woonsocket, Rhode Island.

T-P means TOP PRECISION

Use TAFT-PEIRCE Gages for Every Gaging Need



- HARDENED AND PRECISION GROUND PARTS
- STANDARD CAP SCREWS
- **SPECIAL COLD FORGED PARTS**
- SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST
- JIGS • FIXTURES
- STEAM HEATED PLASTIC MOLDS
- SPECIAL PRODUCTION TOOLS
- R-B INTERCHANGEABLE PUNCHES AND DIES
- DIE MAKERS SUPPLIES

Innumerable parts ordinarily produced by more expensive methods can be cold forged. Tolerances as close as are required for most machined parts can be secured . . . greater strength and durability are obtainable . . . and, through proper engineering and production methods, costs can be reduced materially.

Allied can give you every benefit of this type of production. Send us your part prints for quotation.

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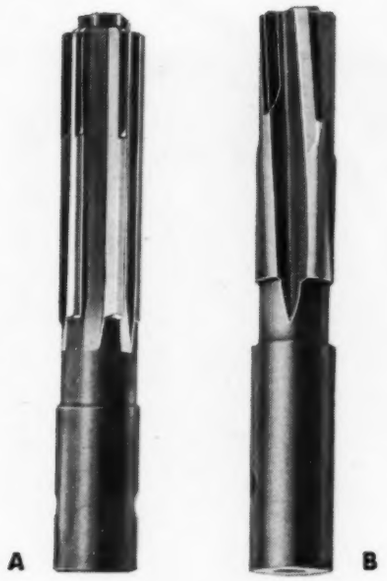
CORPORATION
DEPARTMENT 41
4612 LAWTON AVENUE **DETROIT 8, MICHIGAN**

TOP PRODUCTION TEAM

for HIGH Accuracy and LONG Runs

AUTOMATIC SCREW MACHINES ..... PLUS .....



Staples

CARBOLOY-TIPPED
CEMENTED CARBIDES

STUB SCREW MACHINE REAMERS

(A) Staples Carboloy - tipped Expansion Stub Screw Machine Reamer.

Staples patented expansion principle permits easy adjustment of tool to .0001". Expansion plug limited to $^3/_{32}$" extension beyond tool end (width of cut-off blade) eliminates possibility of plug striking bottom of drilled hole. Can also be furnished with plug flush with tool end if specified.

(B) Staples Carboloy - tipped Solid Stub Screw Machine Reamer.

Staples stub screw machine reamers cut production costs on automatic screw machine operations by eliminating frequent down time for reamer sharpening. Carboloy surfaces are highly resistant to wear—far exceed H.S.S. on tool life. Tools hold accurate diameters, permitting long runs on exceptionally close tolerance work.

These reamers are made both in solid and expansion types. Tools are stocked semi-finished and are ground to size specified with tolerance of .0003" on diameter. A complete range of sizes is available for immediate delivery.

THE STAPLES TOOL COMPANY
CINCINNATI 25, OHIO
Distributors in Major Cities

write for your complete Staples Tool catalog

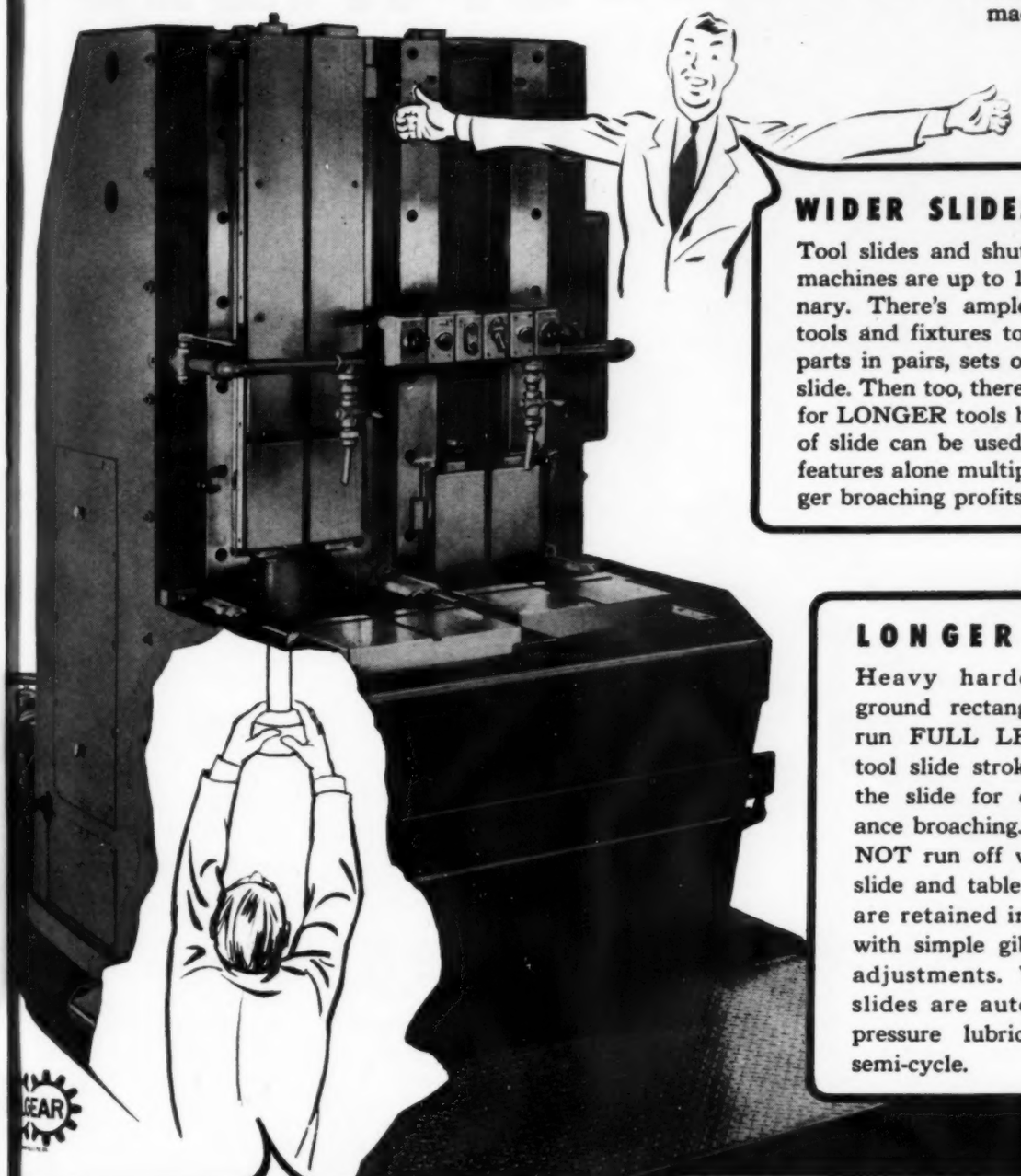
Staples CARBOLOY CEMENTED CARBIDE TOOLS

A COMPLETE LINE OF SINGLE AND MULTIPLE POINT CUTTING TOOLS
EXPANSION REAMERS • FORM TOOLS • CENTERS • MASONRY DRILLS • SPECIAL TOOLS

...IN OILGEAR SURFACE BROACHING MACHINES

When you purchase an Oilgear Surface Broaching Machine you get a big bonus of features which are not incorporated in other machines.

Consider these important features carefully for if you don't get Oilgear *features* you can't get Oilgear *performance*.



WIDER SLIDES AND TABLES

Tool slides and shuttle tables on Oilgear machines are up to 130% wider than ordinary. There's ample room for grouping tools and fixtures to broach two or more parts in pairs, sets or sequence on EACH slide. Then too, there's up to 4" more room for LONGER tools because the full stroke of slide can be used for broaching. These features alone multiply production for bigger broaching profits.

LONGER WAYS

Heavy hardened and ground rectangular ways run FULL LENGTH of tool slide stroke to guide the slide for close tolerance broaching. Slides DO NOT run off ways. Close slide and table clearances are retained indefinitely with simple gib and way adjustments. Ways and slides are automatically pressure lubricated each semi-cycle.

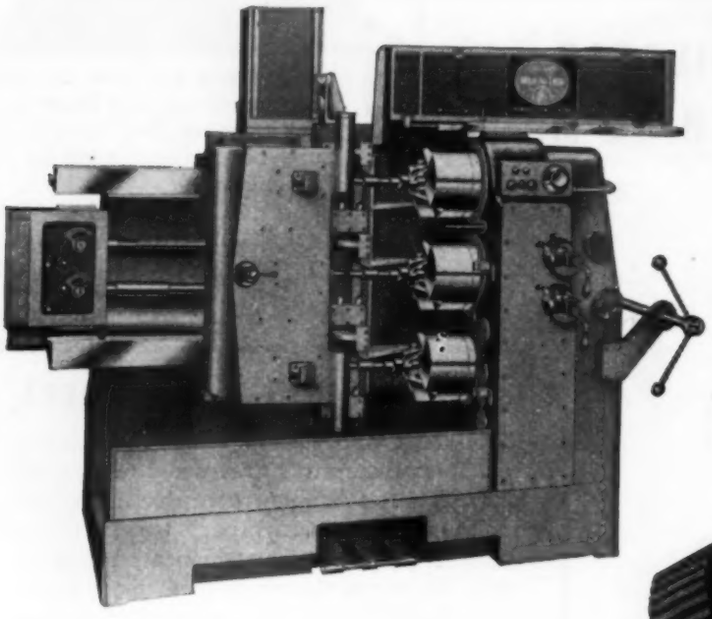
TOOLS ARE PULLED . . . NOT PUSHED

Cylinder ram PULLS slide downward to broach work; ram is in TENSION under broaching load and not in compression. There's no ram DEFLECTION to cause wear on ram, packing and cylinder. Positive delivery of oil to pulling side plus a rigid column of oil on return side gives SMOOTH operation. Then too, you get up to 100% higher return speed and save power with our simple regenerative system.

These are only a few of the many exclusive features in Oilgear Fluid Power Variable Speed Broaching Machines. Write for complete descriptive bulletins. THE OILGEAR COMPANY, 1313 W. Bruce St., Milwaukee 4, Wisconsin.

Oilgear Fluid Power

BULLARD MAN-AU-TROL HORIZONTAL LATHE



SPINDLE RIGIDITY

WITH SKF SPINDLE BEARINGS

Identical tooling and operations for the three spindles of this Man-au-trol Horizontal Lathe produce *three* pieces in less time than normally required for *one*. Responsible for this, to an important degree, is the *rigid application of all component parts* providing extreme rigidity, a minimum of vibration, and a high degree of maintained accuracy. SKF Spindle Mountings assure rigidity, repetitive accuracy and uniformity of finished work. Next time *you* select a spindle design for your machine tools, remember that a wide variety of types and sizes enables SKF to put the right bearings in the right places. 6491

Send For New 60-Page Catalog No. 272

9 Profit Points!

- *maintained spindle accuracy.*
- *radial and axial loads absorbed by separate bearings resulting in maximum radial and axial rigidity.*
- *rigid support of inner ring — elimination of creep.*
- *press fit in housing supports outer ring.*
- *positive control of internal radial clearance.*
- *lapped rollers of "Gauge Makers" accuracy.*
- *no bearing adjustments required for a wide range of speeds, feeds and depths of cuts.*
- *minimum "camming" action.*
- *low friction — low operating temperature.*

SKF
BALL AND ROLLER BEARINGS

SKF INDUSTRIES, INC.
PHILADELPHIA 32, PA.

ON *One* PRECISION LATHE DO ALL THIS AND IN LESS TIME . . .

- BALL TURNING
- SPIRAL CUTTING
- MILLING
- GRINDING
- MULTIPLE OPERATIONS
- RELIEVING
- SLOTTING
- FORMING
- TAPER TURNING

All possible through precision-made attachments.

The Rivett No. 608 back-geared, screw cutting lathe for tool making and instrument shops, handles an endless variety of jobs in minimum time. This small but exceedingly proficient lathe with slide areas equal to that of one twice its size, permits the operator to finish his work completely without employing other machines.

WRITE FOR BULLETIN NO. 608

GUARANTEE

The Rivett 608 will turn or bore within 0.0001″ in six inches — work held in collet, and turn between centers within 0.0001″ in six inches. It will face to eight inches diameter within limit of 0.0002″ concave, 0.0000″ convex. It will cut threads within 0.0005″ in twelve inches, or within 0.0003″ in any three inches, or within 0.0002″ in any inch of a specimen piece.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U. S. A.

Front & Rear Views of Series 23100-A Compensating Heavy-Duty Chuck

Things *were* going to the "DOGS"

. . . until Skinner brought out the new Compensating Power Chuck. This new power chuck not only replaces "dogs" on mass production lathe work, but does such jobs more easily, quickly and accurately. The unique Skinner design allows ⅛" compensation, per jaw, for positive gripping of rough stock with normal variations in size and in centering.

The chuck body is a one-piece steel forging. The center is hardened and ground high speed steel, and fits into a precision ground Morse taper hole in the center plate. The husky center plate is also hardened and ground and is bolted to the chuck body with six sturdy screws. This construction, plus selected alloy steels, properly heat-treated for jaws and all internal parts, is your assurance of maximum accuracy and output for jobs requiring heavy cuts at high speeds with carbide tooling.

The Series 23100-A Compensating Power Chuck saves production time and costs while reducing operator fatigue. It will pay to investigate this new Skinner production tool which has already gained wide acceptance in the mass production field.

Complete details on Skinner Power Chucks, rotating and non-rotating air cylinders, valves, filters and all other Skinner chucking and vise equipment are contained in Catalog No. 60. Write for your free copy today.

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Standard*
Forms secure shoulder, gives tight pressure fit when installed in a groove.
Beveled* and Bowed*
Take up end-play rigidly or resiliently, accommodate accumulated tolerances.
Crescent
Snaps on radially where axial assembly is impossible. No special tools needed.
E-Ring
Provides large strong shoulder for small shafts. Applied radially.
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2-piece ring takes heavy thrusts, gives positive lock, secure against high RPMs.

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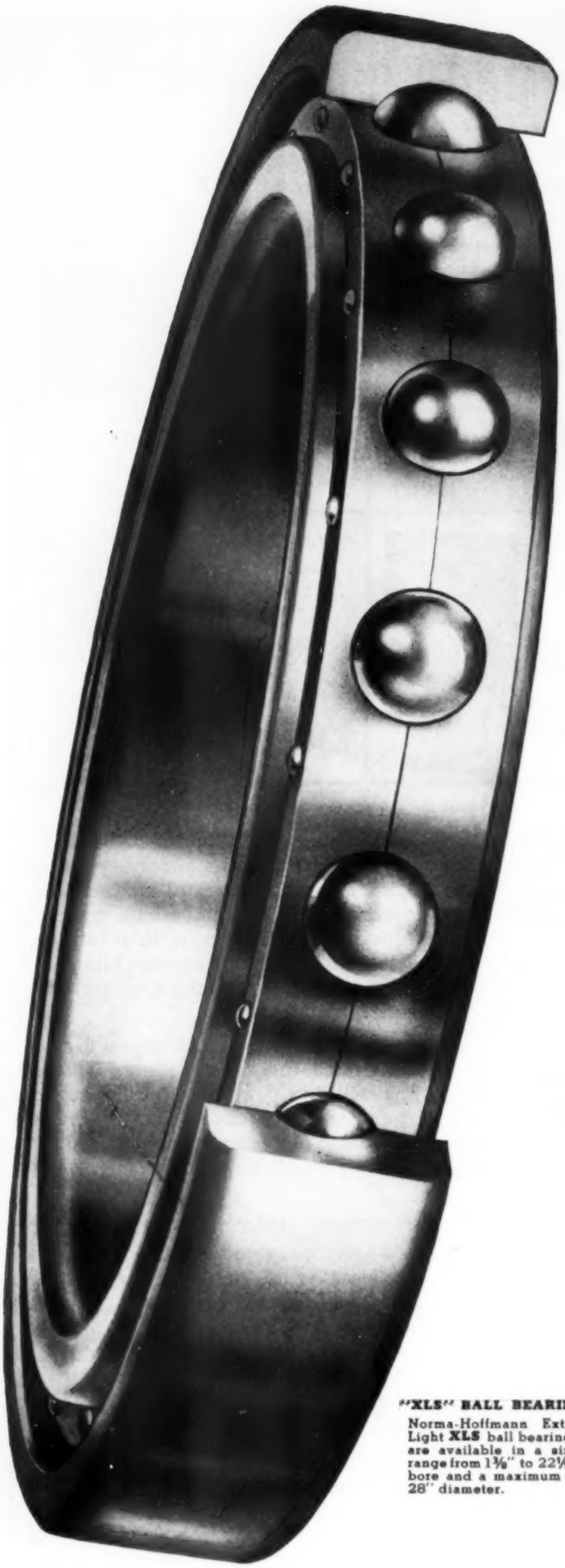

"XLS" BALL BEARING
Norma-Hoffmann Extra Light **XLS** ball bearings are available in a size range from 1⅜" to 22½" bore and a maximum of 28" diameter.

Crowded for Room?

NORMA-HOFFMANN

EXTRA LIGHT **XLS** SERIES

Precision Bearings Provide greater latitude in designs

These Norma-Hoffmann *Extra Light* Precision Ball Bearings—**XLS** types—provide the solution to cramped bearing space in machine design. In addition to the advantages of low friction, compactness and light weight, the abnormally large bores, compared to outside diameter, give designers greater latitude in designs of their equipment. They are also suitable for combined radial and thrust loads in either direction. Investigate Norma-Hoffmann *Extra-Light* Precision Bearings for your designs. Our Field Engineers will gladly aid you in the application and selection of the proper bearing for your particular designs. Write for their services and catalog.

NORMA-HOFFMANN *Precision* **BEARINGS**
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USE PORTABLE GRINDERS FOR:

- Preparing surfaces for welding and smoothing welds.
- Snagging and grinding castings.
- Cutting off old rivets, studs, bolts.
- Removing rust, scale, old paint from tanks and structural metal.
- Grinding, cleaning and buffing frames, cabinets, other assemblies.

USE BENCH GRINDERS FOR:

- Sharpening cold chisels, wood chisels, twist drills and many other tools.
- Handling many types of grinding and metal removal.
- Removing rust; cleaning dirty, gummy parts; preparing surfaces for painting.
- Buffing and polishing plated metal surfaces.

PORTABLE GRINDER FEATURES:

- Splined gear mountings for perfect power transmission.
- Steel bearing inserts for smoother running.
- Welded steel wheel guard for extra safety.
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BENCH GRINDER FEATURES:

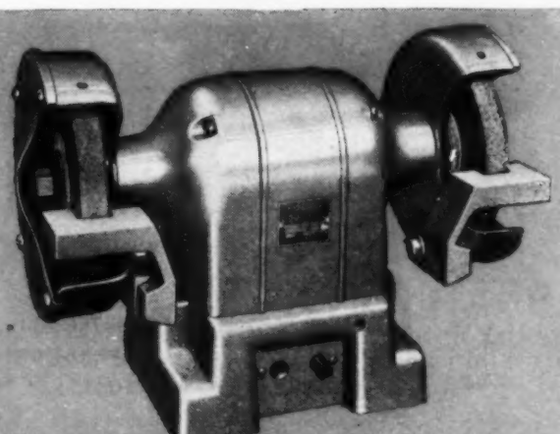
- Streamlined design for more work clearance and less weight.
- Adjustable U-shaped tool rests for better tool sharpening support.
- Strong steel wheel guards for extra safety.
- 8" and 10" Bench Grinders equipped for dust collecting systems.

- PLUS dependable B & D-built "constant speed" motors

..You'll Want Black & Decker Features Like These..

For TOP Performance from the FINEST Bench and Portable Grinders MADE!

4" Portable Grinder..$ 66.00 5" Model...$ 80.00 6" Model...$100.00



BENCH GRINDERS

6" Standard $38.00	8" Heavy-Duty $98.00
6" Heavy-Duty $58.00	10" Model $138.00

Select a Black & Decker Portable Grinder if you want to *bring the tool to the work!* Select a Black & Decker Bench Grinder if you want to *bring the work to the tool!* Whatever your particular need, you'll get years of top-notch service out of these husky, well-built Black & Decker Tools . . . while saving time and money in a hundred-and-one grinding jobs! Give your nearby Black & Decker Distributor a ring for full details on these hard-working Grinders. And write for our free catalog to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Maryland.

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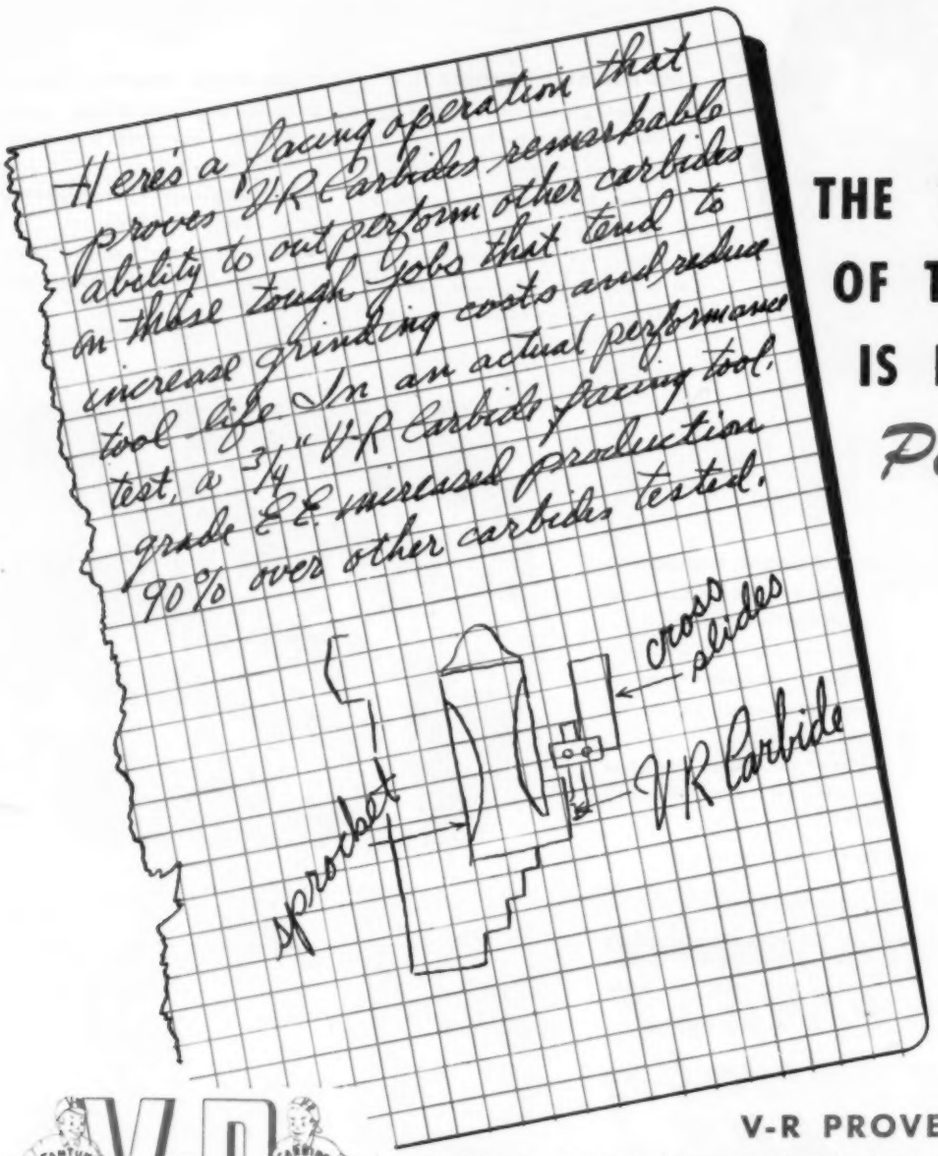
PORTABLE ELECTRIC TOOLS

DRILLS • SANDERS • SCREW DRIVERS
SAWS • HAMMERS • SHEARS


Here's a facing operation that proves V-R Carbides remarkable ability to outperform other carbides on these tough jobs that tend to increase grinding costs and reduce tool life. In an actual performance test, a 3/4" V-R Carbide facing tool, grade EE increased production 90% over other carbides tested.
cross slides
sprocket
V-R Carbide

THE *Proof* OF THE CARBIDE IS IN THE *Performance*

V-R

V-R PROVEN PERFORMANCE

MACHINE: Potter & Johnson Automatic, 6 years old
MATERIAL: Tough, Scaly Steel Castings
OPERATION: Facing sprockets. 1/8" to 1/4" depth of cut from 7 3/4" O.D. to 4 1/8" I.D.
TOOLS: 3/4" Carbide Tipped Facing Tool

The Proof:

	V-R Carbide, Grade EE	Carbide "A"	Carbide "B"	Carbide "C"
S.F.M.:	194 to 116	194 to 116	194 to 116	194 to 116
Feed per Rev.:	Hand Feed	Hand Feed	Hand Feed	Hand Feed
Depth of Cut:	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"
Pcs. per Grind:	100	8	10	9
Remarks:	V-R Carbide finished the remainder of 500 sprockets with a single tool, reground only 5 times.			

Many times the application of V-R Carbides to a particularly difficult problem is unique—the result of an unprecedented need arising from some new development in industry—and V-R Carbides provide sure, economical production. Call your nearest V-R Field Engineer today for a quick, economical solution to YOUR tool problem.

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District Sales and Service in Principal Cities

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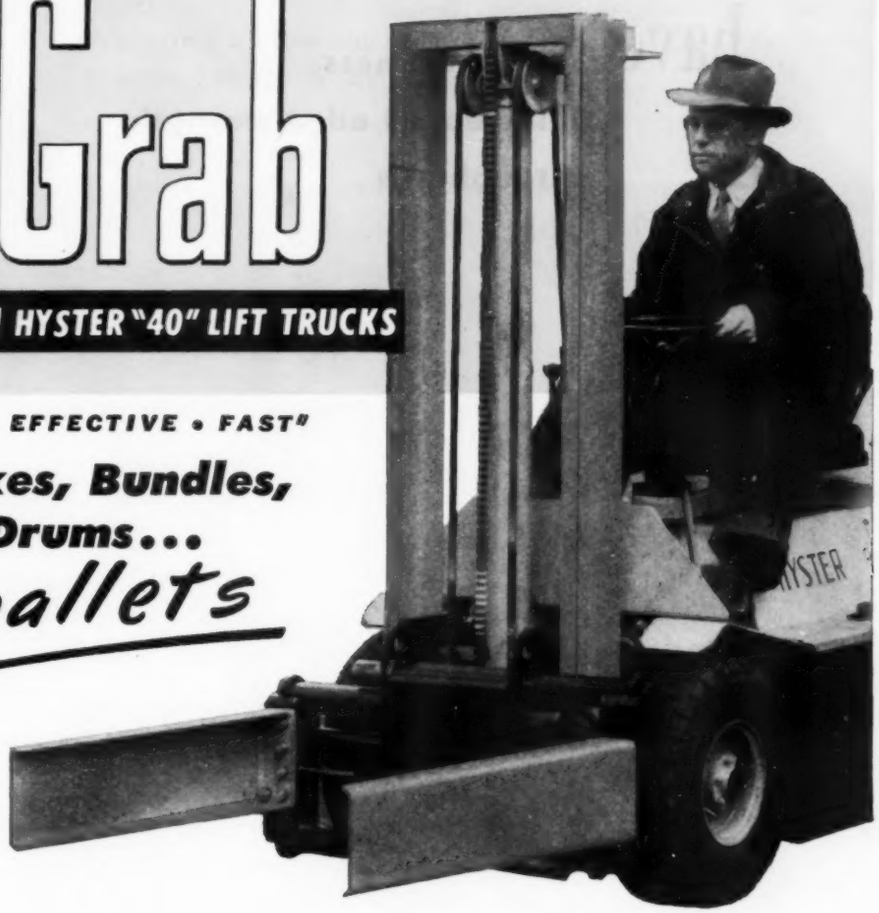
"Greatest advancement in lift truck equipment since pneumatic tires"

HYSTER Load-Grab

for use with HYSTER "20" and HYSTER "40" LIFT TRUCKS



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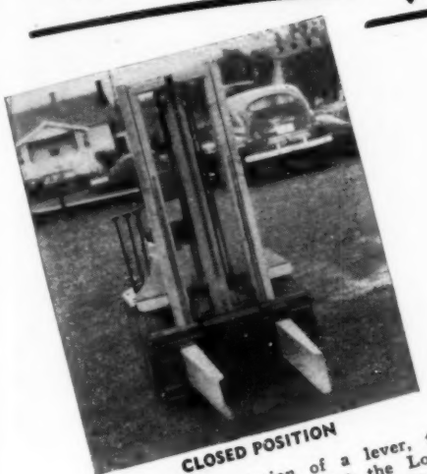
Handles Bales, Boxes, Bundles, Bags, Barrels, Oil Drums... *without pallets*



CLOSED POSITION

By the simple manipulation of a lever, the operator can expand and contract the Load-Grab Arms from the closed 17 in. position to the wide-open position of 62 in. on the Hyster "20" and 66 in. on the Hyster "40".

WIDE-OPEN POSITION

what it is...what it does... Hyster Load-Grab is a simple, sturdy, hydraulically operated clamp device, with several different types and options of load arms. Load-Grab picks up any kind of a load as easily as you pick up a handful of cards.

how it does it... Hyster Load-Grab *side squeezes* with just enough pressure to lift and transport loads without the use of pallets . . . **Regular Load-Grab Arms, Rubber Faced Arms, Spike Faced Arms, Drum Handling Arms and Pallet Load Arms can be interchanged or installed in a few minutes.**

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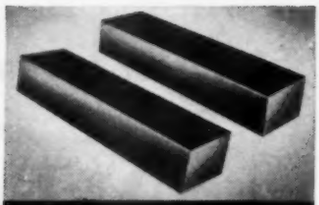
Trade-Mark

have ... red hardness
... increased edge strength
... toughness

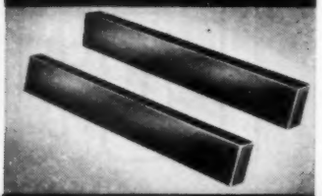
HAYNES STELLITE 98M2 tools are especially suitable for faster production machining of ferrous and non-ferrous metals, plastics, and wood. In addition to the standard tools illustrated, special tools, made to your specifications can be promptly furnished.

98M2 alloy—composed of cobalt, chromium, and tungsten—is inherently hard. And since its hardness is not the result of heat treatment, tools made of this alloy have no "temper" to be affected by high temperatures. They cut efficiently even at red heat, and have a good balance of hardness, edge-strength and toughness. This unusual combination of properties makes possible heavy cuts and coarse feeds at high speeds. This high rate of stock removal assures a low cost per piece machined.

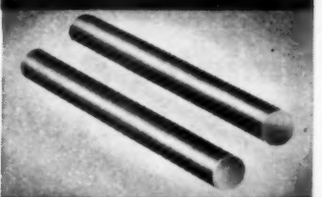
For a complete list of styles, sizes, and prices of stocked standards, write to the nearest district office for a copy of the booklet, "HAYNES STELLITE Metal Cutting Tools" Form 5401.



SQUARE TOOL BITS

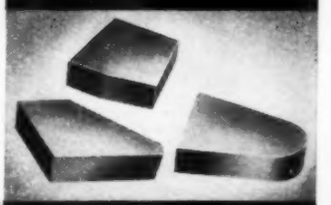


RECTANGULAR TOOL BITS



ROUND TOOL BITS

TIPPED TOOLS



TOOL TIPS

INSERT MILLING CUTTER BLADES

HAYNES TRADE-MARK alloys

Haynes Stellite Company
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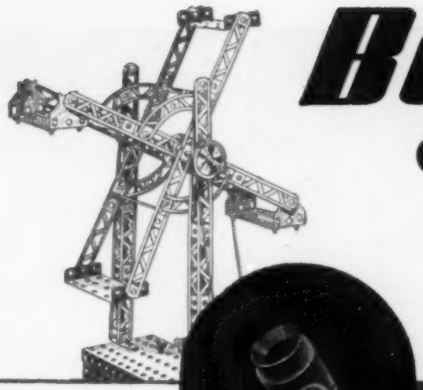
The registered trade-marks, "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

Bodine

CASE HISTORY No. 23

Processing a brass hub used in the famous Erector Set made by A. C. Gilbert Co.



1

HAND LOAD SCREW MACHINE BLANK TO DIAL.

2

SPOT DRILL AND C'SINK FOR SET SCREW HOLE.

3

DRILL No. 33 SET SCREW HOLE.

4

TAP 6-32 SET SCREW HOLE.

5

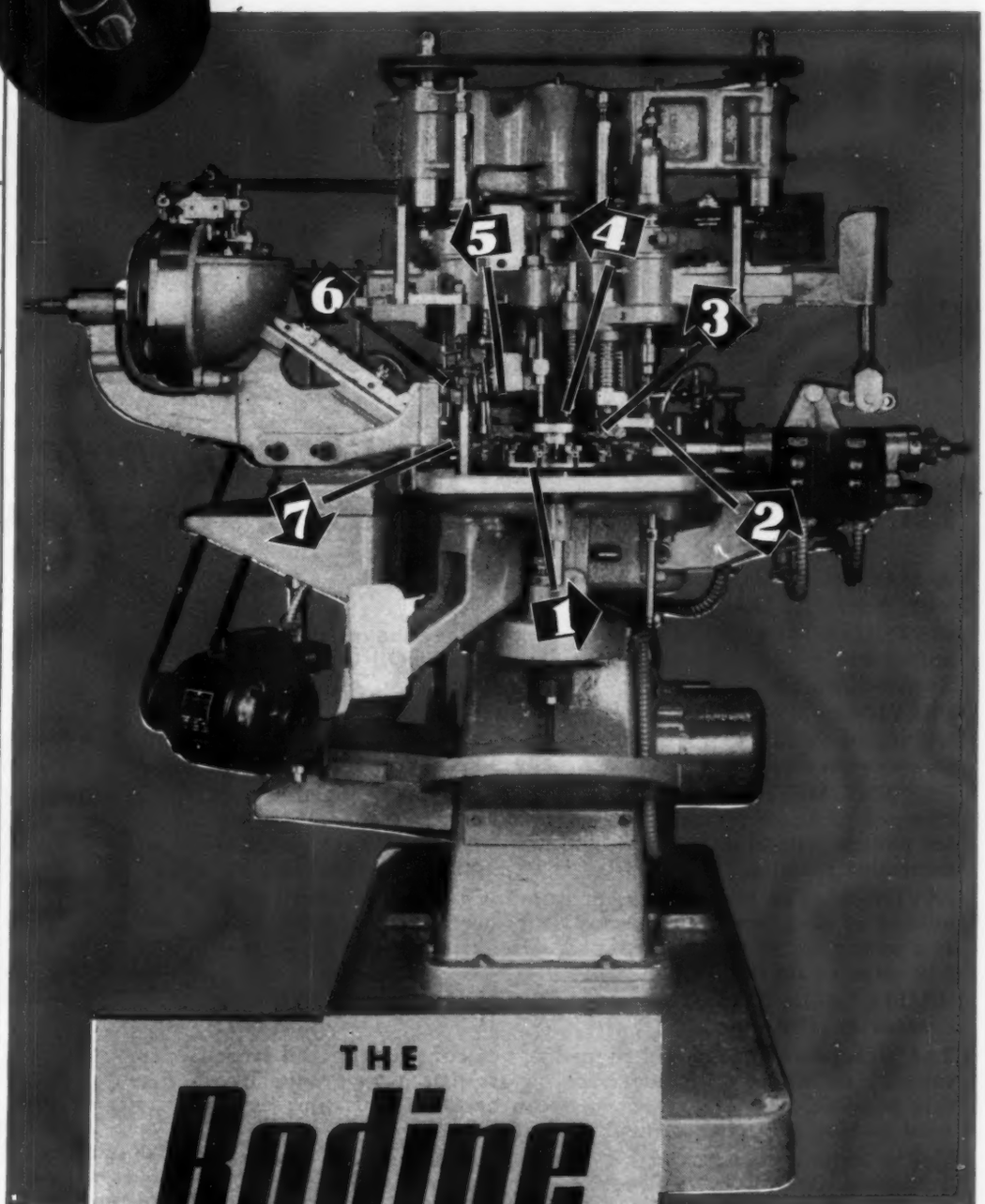
CROSS REAM .161 DIA. SHAFT HOLE TO SIZE, REMOVE BURRS WITH HORIZONTAL DRILL SPINDLE.

6

HOPPER FEED AND INSERT No. 6-32 SCREW IN TAPPED HOLE.

7

AUTOMATICALLY INSPECT AND EJECT.



"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE **Bodine** CORPORATION

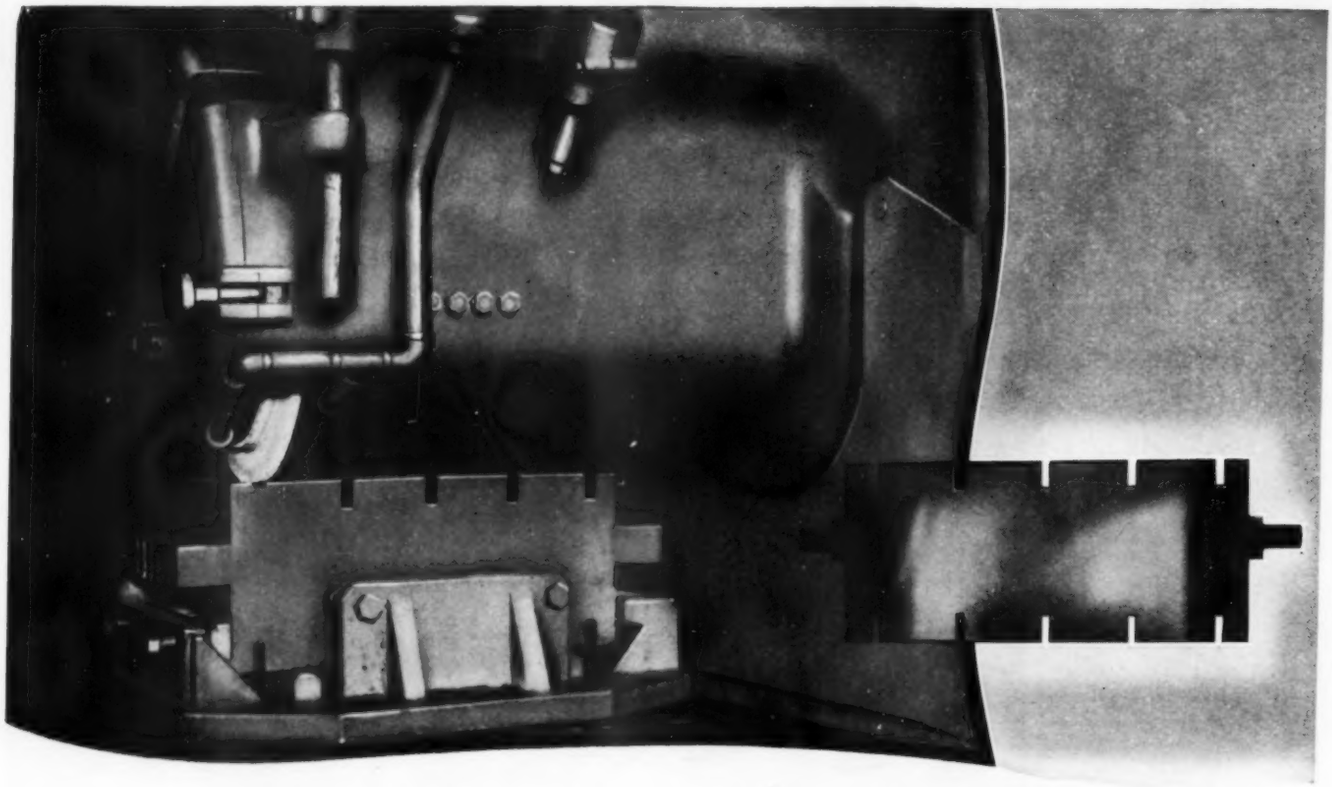
BRIDGEPORT 5 CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING TAPPING, AND SCREW INSERTING MACHINES

PRODUCTION: Completely automatic except for loading. No. 40-10 Bodine machine produces 2400 pieces (12,000 operations) per hour. Perhaps a Bodine machine (6 standard sizes) can be tooled to produce some of your components. Why not investigate.

SEND FOR BULLETIN

EBD48



PLUNGE CUT GRINDING *Saves 90 minutes per plate*
ELIMINATES MILLING OF SLOTS, REWORK AND SCRAP

● MACHINE: Mattison High-Powered Precision Surface Grinder with Automatic Down Feed.

MATERIAL: 1¼″ x 8¼″ SAE 1020 Steel ground to thickness, milled and ground to length, Heat Treated and Oil Quenched to Rockwell 50-55C.

PREVIOUS METHOD: Plates were rough milled to .468″ slot width and slot ground after heat treating. This method produced an excess of scrap because of slot distortion due to heat treatment.

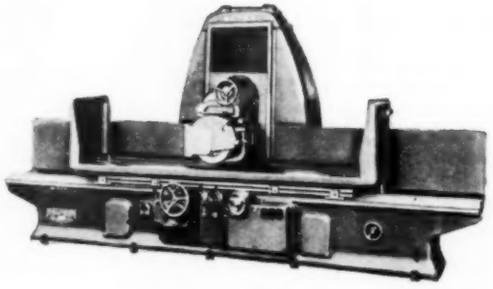
PRESENT METHOD: Twenty plates are assembled together and clamped to magnetic chuck. The slots .500″ wide by 1.250 deep are plunge ground to size, one slot at a time, with length gauge to determine spacing. Depth of cut is controlled automatically.

SAVINGS: The new plunge cut grinding method eliminates the milling of slots, rework and scrap. On the 1¼″ thick plates there is a saving of 90 minutes per plate, 105 minutes on the ¾″ and 110 minutes on the ½″.

WHEEL USED: Norton 20″ x .515″ x 8″ dia. hole No. 57A4605V dressed to .499″ plus .001″.

The high power, speed and ruggedness of construction and large capacity of Mattison Grinders are factors that make results like this possible. To determine what can be done with your work send us blue prints for production estimates.

The above data on savings of time and material was effected by a Mattison Surface Grinder at the plant of Besser Manufacturing Co., of Alpena, Mich. The information was submitted by Mr. R. M. Douglas, Vice-Presidnet and Production Manager.



Write for Free Set-Up Book showing how others have reduced time and cut costs with Mattison Grinders.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

you name it—

The new Airco 700 Welds It ...from thin metal to 2" plate

Why? Because this new torch is available with a selection of tip assemblies that range all the way from Size 00 through the large No. 10 size.

This wide tip selection makes the Airco 700 suitable for your welding work — from thinnest sheet metal up to sections 2" in thickness. When equipped with a multiflame tip, this torch is tops for silver and aluminum brazing.

Each welding tip is assembled with an individual mixer drilled for that particular tip. In addition to wide operating range, other features of the "700" are: better flame control ... perfect balance ... and low maintenance cost.

With the addition of a cutting attachment, the Airco 700 can be easily converted to handle general shop cutting work.

If you would like more information about this torch, or a free demonstration right in your own shop, address Dept. A' 8468, Air Reduction, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas. On West Coast: Air Reduction Pacific Company, San Francisco 4, California.

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For Faster PRODUCTION

- ✓ RIVETING
- ✓ PUNCHING
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- ✓ SHEARING

Hy-Power HYDRAULIC EQUIPMENT

THIS is the modern, economical way to handle your production riveting . . . punching . . . pressing . . . shearing. Take advantage of Hannifin's newest "Hy-Power" tools and equipment for faster production.

FAST! Push button control; automatic operating cycle. Time cycle for standard riveters ranges from 1½ seconds to 3 seconds per rivet for 3" or 4" stroke units.

EFFICIENT! more work with less effort, no noise. Easy to maintain almost unbelievably high production rates. Low power costs. Every operating convenience.

COMPLETE LINE. Portable and stationary types for every purpose. Standard and special designs available. Capacities to 100 tons; reach to 6 ft., or more. Specially designed yokes for reaching "hard-to-get-at" work.

ENGINEERING RECOMMENDATIONS. Hannifin field engineers are specialists in the application and use of "Hy-Power" equipment. Get their recommendations for faster production. Complete information and literature on request.

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PNEUMATIC PRESSES • HYDRAULIC RIVETERS • AIR CONTROL VALVES

Nationwide Sales and Service

NO WONDER
Machine Shops are Enthusiastic *about*
NEW BULL DOG V-Belts

Fractional Horsepower (FHP) V-Belts are available in three standard sections, full range of lengths.

Bull Dog Industrial V-Belts are available in A, B, C, D and E sections, full range of lengths.

In these days of high operating costs, any product that boosts efficiency wins a warm welcome. So it's only natural that these rugged new Bull Dog V-Belts have won instant acceptance in an industry where steady, dependable, low-cost power is a basic need. In fact, leading industries everywhere have acclaimed Bull Dogs as the last word in V-Belt proficiency.

For more than 70 years, the name BWH has been known as a symbol of EXTRA service on mechanical rubber goods. And the new Bull Dog V-Belts proved in test after test that they assure exceptionally economical, trouble-free operation on all types of machinery.

Here's What Makes BWH Bull Dog V-Belts Outstanding:

1. ***Exclusive Bull Dog Cord Section with Higher Tensile Strength*** — able to carry the load and absorb shock.
2. ***Low Stretch*** — because Bull Dog Cords are processed in a new way. This means less slippage, fewer adjustments, longer belt life.
3. ***Cool Running*** — quality-controlled compounds developed in BWH laboratories don't crack or deteriorate under severe flexing.
4. ***Wear-Resistant Covers*** — made of bias-cut heavy fabric to protect the heart of the belt from dirt, grease, moisture.

SPECIFY BULL DOG V-BELTS FOR "MORE POWER TO YOU"

When you need V-Belts or other mechanical rubber goods, look to BWH for products of dependable ruggedness — BWH distributors for dependable service.

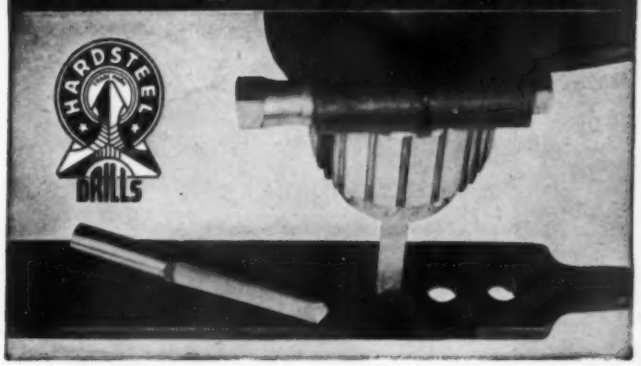
Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all principal cities

PLANT: CAMBRIDGE, MASS., U. S. A. • P. O. BOX 1071, BOSTON 3, MASS.

Drill Hardened Steels *without Annealing* with "HARDSTEEL"



Don't let anyone tell you that hardened steels must be annealed before drilling, countersinking, counterboring or reaming.

With "HARDSTEEL" drills you can produce accurate, smooth holes in steels hardened by any process — oil-hardened, water hardened, cyanided, nitrided, and they work equally well on work-hardening steels, and high carbon-high chrome steels of any degree of hardness.

"HARDSTEEL" drills used with standard drill presses cut costs in production shops because parts drilled after hardening always match at assembly. In service shops they save time and material and permit engineering changes calling for additional drilling to be made after parts are full hardened.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are now functioning in thousands of plants in parts recovery operations.

You Harden It — We'll Drill It — with "HARDSTEEL"

"HARDSTEEL" Tool bits make faster, deeper cuts on steels and non-ferrous alloys.

BLACK DRILL CO.
Division Black Industries
1388 East 222nd Street
CLEVELAND 17, OHIO

"HARDSTEEL"
DRILLS • TOOL BITS • SPECIALS

PUMPS

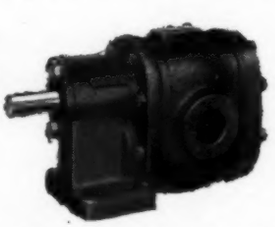
that
"NEVER LET YOU DOWN"
. . . for

- ★ *circulating liquids*
- ★ *transferring liquids*
- ★ *supplying lubricant*
- ★ *supplying coolant*
- ★ *hydraulic installations*

The simple, sturdy construction and dependable, trouble-free operation of Brown & Sharpe Pumps are widely recognized throughout industry.
Brown & Sharpe Rotary Geared Pumps are made in several stock styles and sizes . . . capacities from ½ gallon per minute at 0 lbs. pressure to 37.6 gallons per minute at 0 lbs. pressure . . . for pressures up to 500 psi. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

Nos. 15, 25 and 35 Rotary Geared Pumps with helical gears — for coolant, general circulation and low pressure hydraulic service. Renewable bearings. Mechanical Seals. With or without relief valves.



Nos. 53 and 55 Rotary Geared Pumps with roller bearings and helical gears; for hydraulic installations. Supply oil under pressure. Although designed for direct drive, can be pulley or gear driven.

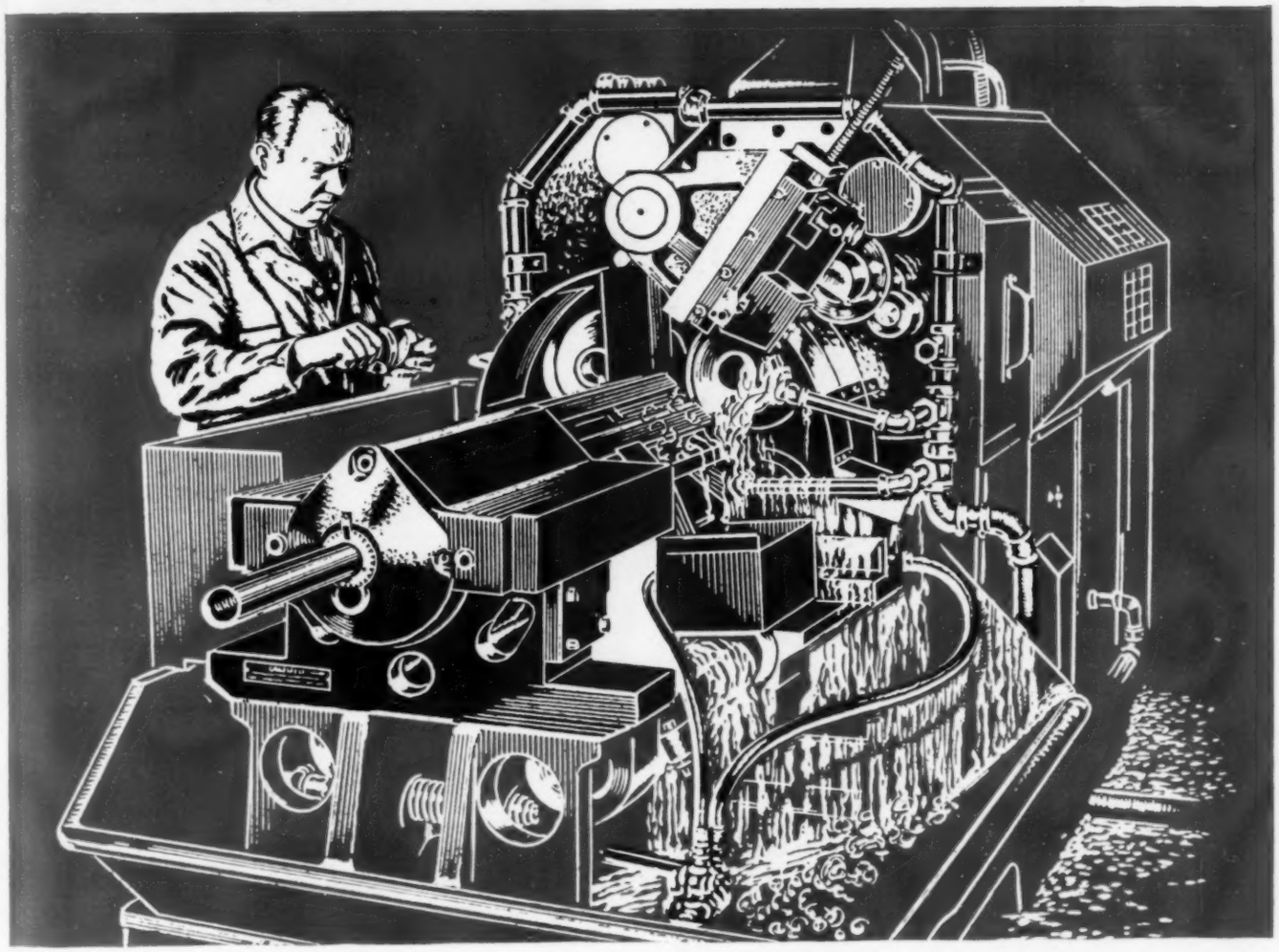
The 500 Series Rotary Geared Pumps — for hydraulic installations. Quiet at high speeds and under pressures to 500 psi. Moving parts balanced hydraulically for end thrust.

Nos. 21 and 23 Bronze Rotary Geared Pumps . . . suitable for providing circulation on water-jacketed engines and for pumping saline solutions.

CENTRIFUGAL • GEARED • VANE • MOTOR DRIVEN

BROWN & SHARPE PUMPS B·S

YES! Tycol Afton Cutting Oils perform better . . . BETTER . . . BETTER



Tycol Afton Cutting Oils perform better because:

. . . *Tycol Afton Cutting Oils* are expertly blended, non-corrosive, sulphurized oils with a "dual purpose" . . . you use them for BOTH cutting and machine lubrication and get better results BOTH ways.

. . . *Tycol Afton Cutting Oils* have quicker cooling properties and completely protect bearings and gears—they will not gum, corrode or tarnish machined parts.

. . . *Tycol Afton Cutting Oils* permit freer cutting and longer tool life by minimizing the build-up on cutting tools . . . closer tolerances and finer finishes are assured.

. . . *Tycol Afton Cutting Oils* fill every requisite for ferrous and non-ferrous metals from light machines to heavy machine broaching work.

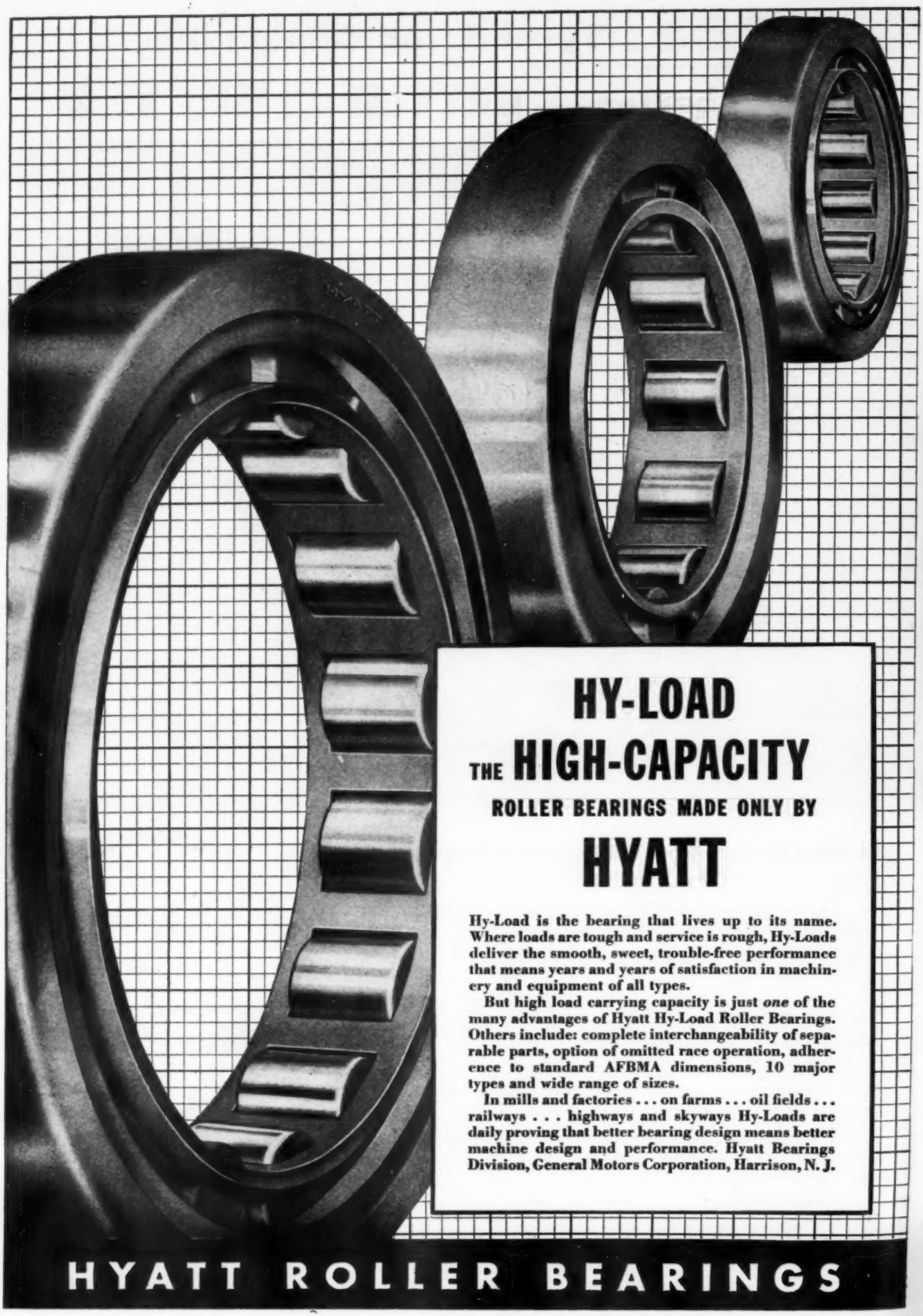
For complete information about Tycol Afton Cutting Oils and the other lubricants that make up the complete Tycol line, contact your nearest Tide Water Associated Office today.

TYCOL
INDUSTRIAL LUBRICANTS

**Boston • Charlotte, N. C.
Pittsburgh • Philadelphia
Chicago • Detroit • Tulsa
Cleveland • San Francisco**

TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

LUBRICATION — "ENGINEERED TO FIT THE JOB"



HY-LOAD
THE HIGH-CAPACITY
ROLLER BEARINGS MADE ONLY BY
HYATT

Hy-Load is the bearing that lives up to its name. Where loads are tough and service is rough, Hy-Loads deliver the smooth, sweet, trouble-free performance that means years and years of satisfaction in machinery and equipment of all types.

But high load carrying capacity is just *one* of the many advantages of Hyatt Hy-Load Roller Bearings. Others include: complete interchangeability of separable parts, option of omitted race operation, adherence to standard AFBMA dimensions, 10 major types and wide range of sizes.

In mills and factories . . . on farms . . . oil fields . . . railways . . . highways and skyways Hy-Loads are daily proving that better bearing design means better machine design and performance. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

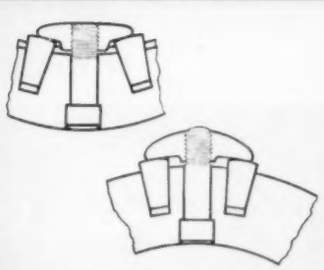
HYATT ROLLER BEARINGS

Continental ENGINEERING IN CUTTING TOOLS Makes the Big Difference!

Below: Rough milling a casting with a Continental Inside Cone Face Milling Cutter. This type of cutter is especially economical in rough milling because the principal direction of blade adjustment is toward the periphery where major wear occurs.

Above: Continental Inside Cone Face Milling Cutter for roughing and general purpose work.

Above: Continental Outside Cone Face Milling Cutter for finishing and general purpose work.



Above: These illustrations show how blades are locked in Continental Face Milling Cutters—inside cone type at the left and outside cone type at the right. One clamp locks two blades securely in place — no wedges, pins or set screws are used — no special tools are required.

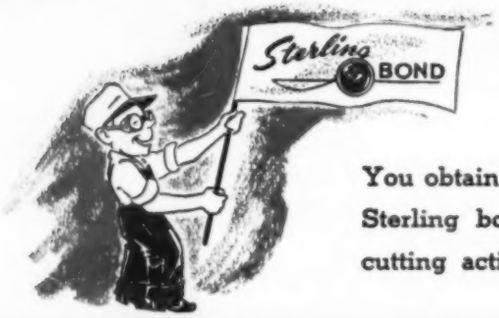
CONTINENTAL **cutting tools made by Ex-Cell-O** ***(from standard counterbores and face milling cutters to all types of broaches and special carbide-tipped tools of intricate design)*** **are now used almost universally throughout the metal-working industry in shops both large and small. This exceptionally wide experience in designing and manufacturing cutting tools is one of the reasons why every Continental cutting tool leaving the Ex-Cell-O plant—no matter what the cutting material or the purpose of the specific tool may be—faithfully represents the high Ex-Cell-O standard . . .** ***assurance of correctness in design, thoroughness in manufacture, and the most practicable of accuracy and production in operation....*** **Prompt delivery can be made of Continental standard and special tools—call in your Continental representative today, or write to Continental in Detroit.**

CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

1948

engineered to a degree of excellence that assures unusual speed and economy

● Increased production is always possible in grinding departments when proper wheels are used. Sterling's "Wheels of Industry" combine the correct bond, grain, structure, size and shape for the solution of all your grinding problems—with speed and economy.



STERLING BONDS *Promote Efficiency*

You obtain all the grinding possible from wheels containing Sterling bonds. . . . Engineered to produce the utmost cutting action from every abrasive grain. . . . .

• STERLING ABRASIVES •

THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

WHEN CORROSION RESISTANCE AND HIGH STRENGTH ARE ESSENTIAL . . .

Tuf-Stuf

IS OFTEN THE SOLUTION

TUF-STUF is the Mueller Brass Co. trade name for Aluminum Bronze. It is furnished in a series of five different alloys, depending upon the purpose for which it is intended.

PROPERTIES

The outstanding properties of TUF-STUF are wear resistance —corrosion resistance—high strength over a wide range of temperatures (sub-zero and elevated)—high brinell hardness on the heat treatable type of alloys—ability to withstand shock—high compressive strength and resistance to fatigue —lighter in weight than other copper base alloys.

SOME OF THE MANY APPLICATIONS OF TUF-STUF

Gears • Worm Wheels • Bushings • Bearings • Lead Screw Nuts • Valve Seat Inserts and Spark Plug Inserts in airplane engines • Shifter Forks • Valve Stems • Rocker Arm Bushings • Tie Rods, Nuts, and Washers for pickle tanks • Window Bolts • Parts in contact with steam, brine, sea water, weak acids and alkalis, crude oils, disinfectants, plant sprays.

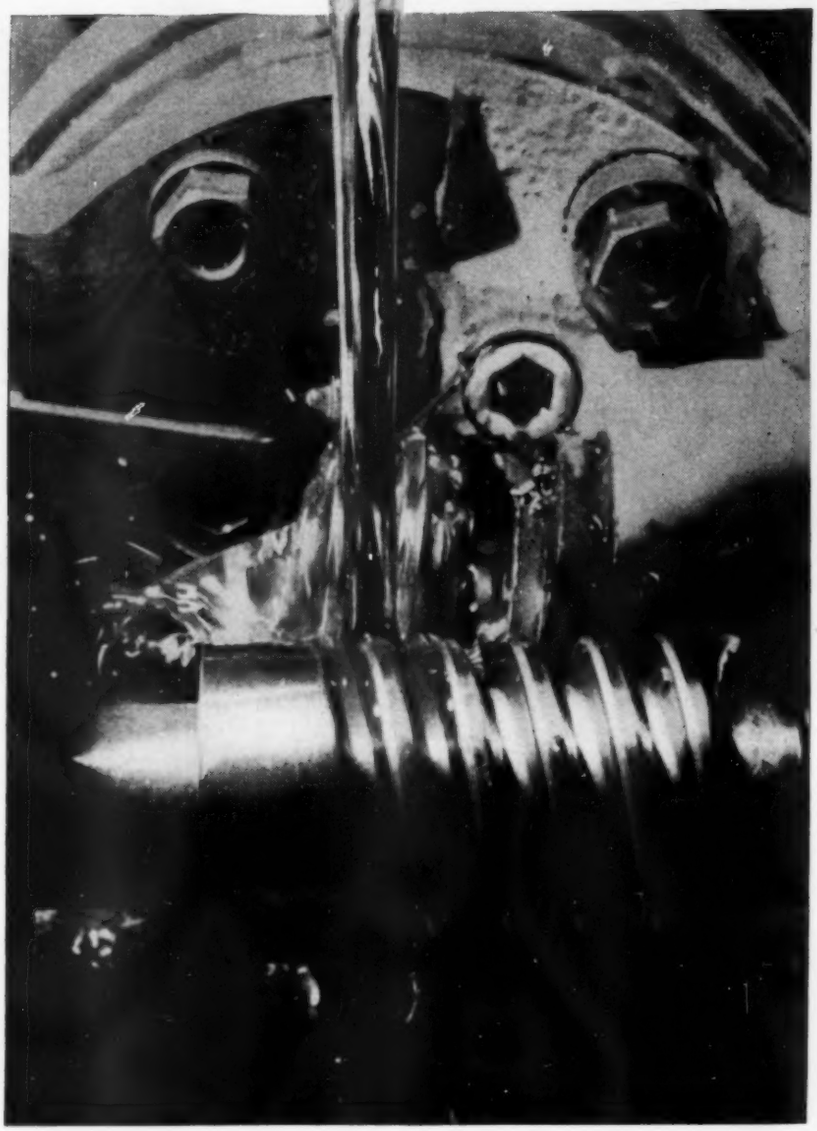
TUF-STUF Alloys are not susceptible to corrosion cracking. TUF-STUF Alloys are furnished in the form of forgings, rods and screw machine parts.

If you have a metal problem, TUF-STUF may be the answer. Let us send you complete literature on all Mueller Brass Co. alloys with their physical and chemical properties and uses. Write for catalog 3-A.

MUELLER BRASS CO.
PORT HURON, MICHIGAN

It's transparent!

New cutting oil gives visibility on precision work!



● Here's an operation where a transparent cutting oil can often mean the difference between a perfectly finished precision job and another costly reject. It's a Pratt & Whitney Thread Miller cutting a worm on an NE-8617-CD steel blank. Feed is .030 in. per revolution and .003 in. per tooth, with a 5 in. HSS cutter operating at 207 r.p.m., corresponding to a surface cutting speed of 220 s.f.m.

With the new S/V Sultran cutting oil, the operator has full visibility of the work throughout the job. Accuracy and finish may be constantly observed, rejects kept to a minimum, top production maintained.

And transparency is only one advantage of this great new advance in cutting oils. Exceptional lubricity, good anti-weld and pressure-resisting qualities and maximum cooling characteristics all contribute to finer finish, longer tool life. On many operations, users find that they can use heavier feeds, higher cutting speeds. In other cases, longer periods between tool changes result in reduced down-time, increased machine production. Freedom from objectionable odor and eye-burning effect are other benefits.

Get these improved cutting oils in your plant now.

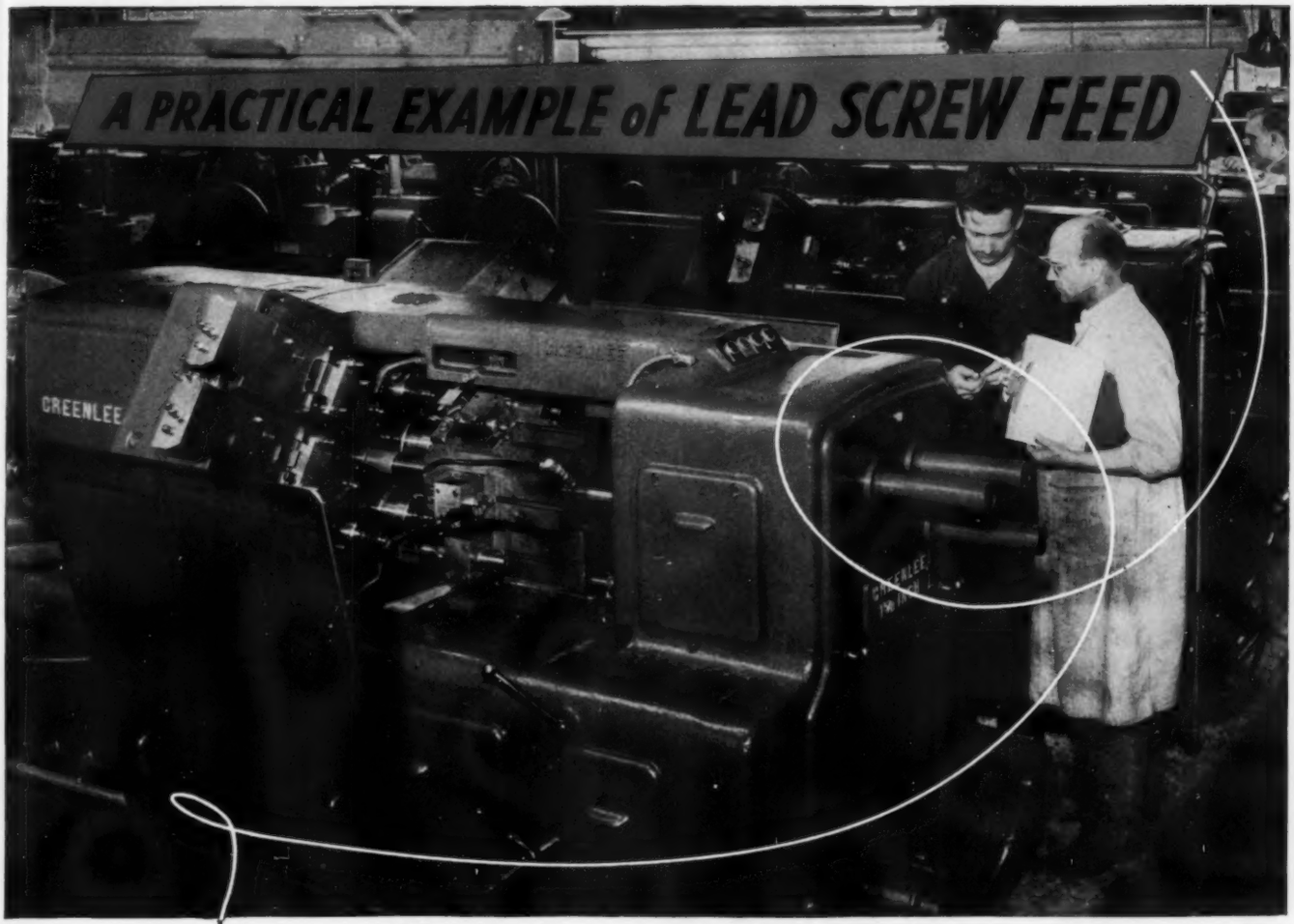
SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORPORATION

GARGOYLE Lubricants

SOCONY-VACUUM

Socony-Vacuum Correct Lubrication

FOR EVERY MACHINE . . . EVERY OPERATING CONDITION



FOR *Better* PRECISION THREADING ON

GREENLEE SIX-SPINDLE AUTOMATICS

SET-UP DATA

PART: 1″ Hose Stem. MATERIAL: 1½″ hex. B1113 Steel.

Position	Operation
1	Form Pipe Diameter. Spot Drill (60° grind).
2	Rough Form Back of Hex. Drill 57/64″ Hole and Face End. (High Speed Drilling Unit).
3	Finish Form Back of Hex. Drill ⅞″ Hole Part Way (High Speed Drilling Unit). Finish Seat, 30° Knee Tool.
4	Rough Form Remainder. Drill ⅞″ Hole Through. (High Speed Drilling Unit).
5	Finish Form. Cut 1″ Tapered Pipe Thread (Lead-Screw Feed Unit).
6	Cut Off.

FEED: 0.013″. STROKE: 1½″
RUN: 10,000

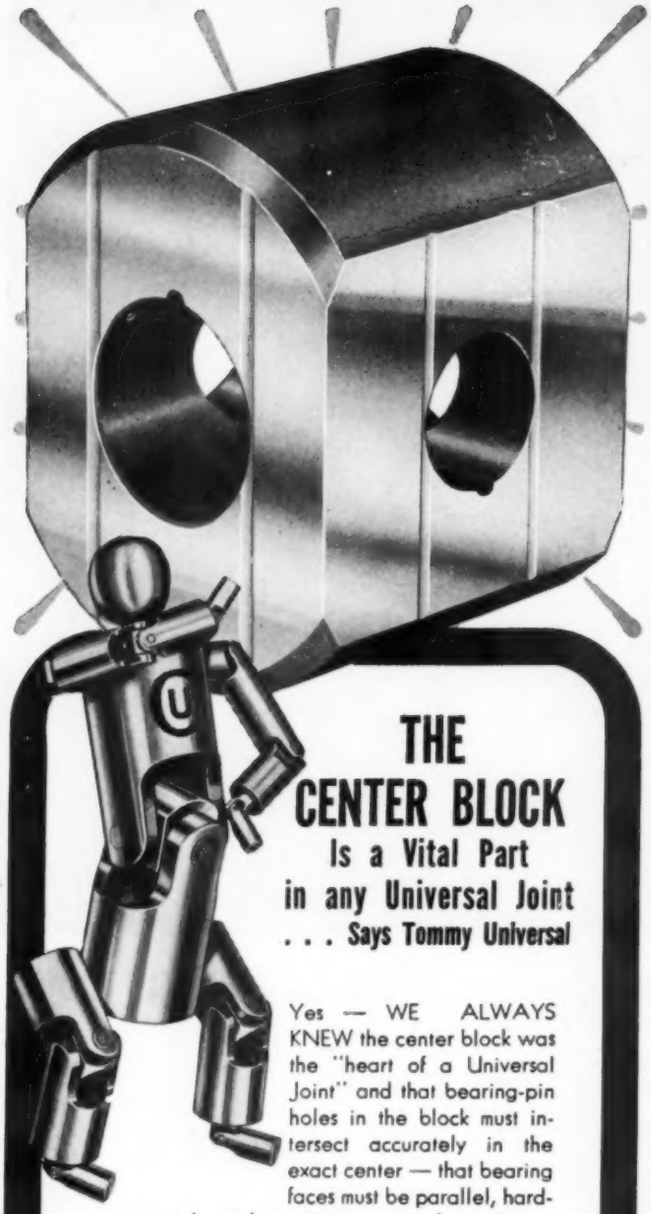
To improve the quality and appearance of their product — industrial hose fittings and couplings — the Anchor Coupling Company at Libertyville, Illinois, are making efficient use of the new Greenlee Lead-Screw Feed on fussy threading jobs. The hose stem part illustrated above has a 1″ tapered pipe thread cut to a length of ⅞″. The job requirement called for high production, a uniform precision-cut thread from start to finish, and a good external finish. How this job was handled using the smooth positive action of the lead-screw feed on a Greenlee "6" is described at the left. In addition to meeting job requirements, an estimated 10 percent reduction in production costs resulted. Today, more of the same equipment is employed by the Anchor Coupling Co. in the manufacture of a quality line of products.

PRODUCTION MACHINERY
GREENLEE

WRITE FOR free literature describing the new interchangeable lead-screw feed and the quick-change advantages of the Greenlee Automatic.

GREENLEE BROS. & CO.
1728 MASON AVE., ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES



THE CENTER BLOCK

Is a Vital Part in any Universal Joint . . . Says Tommy Universal

Yes — WE ALWAYS KNEW the center block was the "heart of a Universal Joint" and that bearing-pin holes in the block must intersect accurately in the exact center — that bearing faces must be parallel, hardened, and precision ground to insure smooth, trouble-free, long-lived operation.

BUT — WE NOW KNOW from recent extensive laboratory tests that two parallel lubrication grooves on each of the four (4) bearing surfaces of the center block reduce heat.

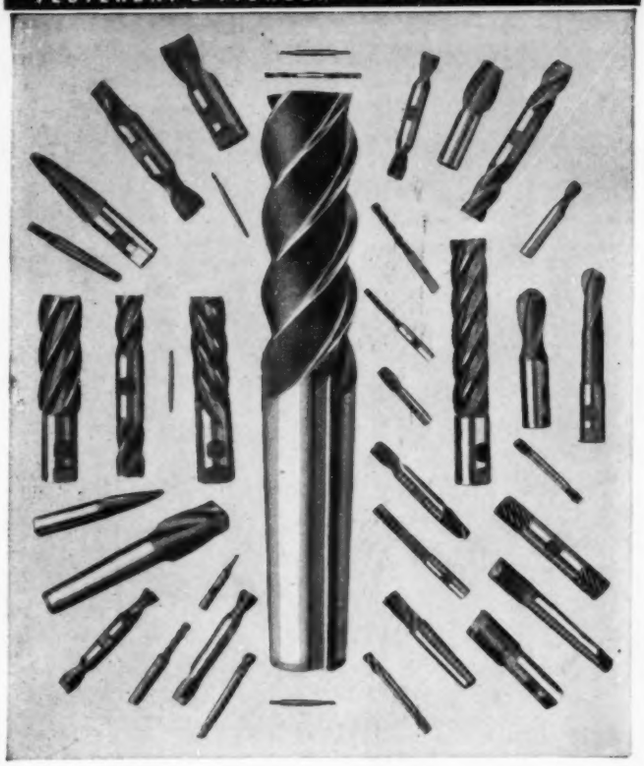
DO YOU KNOW you can now buy Curtis Universal Joints in sizes from 1¼" up for ⅝" or larger shafts — equipped with this new LO-FRICTION center block **at no extra cost?**

Be sure to specify Curtis Universal Joints — available from stock in 14 standard sizes, either single or double, for heavy duty installations — Curtis "Ball-Type" Universal Joints in 4 sizes for high speed light-duty or hand-operated installations.

WRITE DEPT. B-3

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD MASS.

YESTERDAY'S PIONEER . . . TODAY'S LEADER



Quality END MILLS

When you think of end mills, large or small, stock or special, always think of WELDON quality end mills. WELDON was the pioneer in the end mill field, establishing leadership, which it still maintains, by originating features which vastly improved performance and contributed to longer life and dependability of these important tools. The assortment of end mills and holders is complete with a wide range of sizes and styles to meet every requirement.

Insist on WELDON Tools for Well Done jobs.

Write for Catalog 8-B.

THE WELDON TOOL CO. *Cleveland 4, Ohio*

3000 WOODHILL ROAD

Oakite Composition No. 97 gets rid of these four metal-cleaning headaches . . .

- fire hazards
- solid-particle residues after grease is removed
- toxic vapors
- foaming solution

gives you these four advantages . . .

- economical water-diluted emulsions
- long life for cleaning solutions
- speedy cleaning
- rust prevention

SPECIALLY designed for spray-machine washing of steel, brass and zinc parts, Oakite Composition No. 97 quickly wets and dissolves the grease binders in buffing compounds and similar deposits . . . penetrates and loosens dirt formations for easy rinse-away. Use Oakite Composition No. 97 to clean and degrease metal before pre-paint treatments, machining and electrocleaning.

At no cost to you, the Oakite Technical Service Representative will gladly show you how Oakite Composition No. 97 can fit economically into your metal cleaning procedures. Contact him or write us and we'll have him call.

OAKITE PRODUCTS, INC.
24 Thames Street, NEW YORK 6, N. Y.
Technical Service Representatives Located in Principal Cities of United States and Canada

MATERIALS
METHODS
SERVICE

OAKITE

Specialized Industrial Cleaning

Metal-Cleaning Jobs You Can Simplify with Oakite Materials

STEAM-CLEAN with Oakite Composition No. 92. Speedy detergency combined with heat of steam saves time. Data in *free* Service Report 7238.

REVERSE-CURRENT cleaning with Oakite Composition No. 90. High conductivity; controlled foam; long solution life. Details on request.

CONDITION METAL for organic finishes with Oakite CrysCoat. Leaves inert phosphate film to which paint holds firmly. Stops undercoat corrosion. Data in *free* Service Report 6731R.

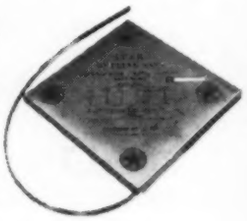
BALL-BURNISH with Oakite Composition No. 3. Superior lubrication; rich suds; works in hard or soft water. Data *free* in Service Report 6705.

To get the above Oakite Service Reports FREE, check, clip and send with your name to Oakite Products, Inc., 24 Thames St., New York 6, N. Y.

BAND SAWS
(Metal Cutting, including Skip-tooth)

THE right blade for *every* job a hack saw or band saw can do—that's what your Star supplier offers. And Star has the *line* to back him up—a *complete* line.

Whether you cut metals or non-metallics — see your Star supplier. He has the blade for longer service, fewer blade replacements — faster, cleaner cutting on any material—the *right* blade for YOU. Ask him for your free copy of "Metal Cutting" — valuable booklet of hints, helps, specifications, prices.



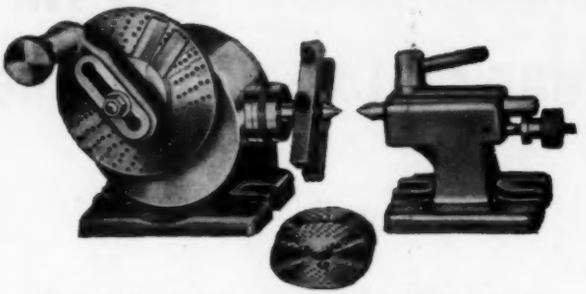
Sold only through recognized distributors

CLEMSON

CLEMSON BROS., Inc., Middletown, N. Y.
Makers of hand and power hack saw blades, frames, metal cutting band saw blades and the Clemson E-17 lawn machine.

2101

L-W HIGH QUALITY UNIVERSAL DIVIDING HEADS



Made by America's Largest Builders of Dividing Heads

ACCURATE AND LOW PRICED, TOO!

Well built for hard daily usage. Rugged head and tailstock. Alloy steel spindle has a tapered bearing. Head tilts to 90° in vertical position. Special alloy steel worm and bronze worm wheel cut to close limits for accuracy. Complete with three index plates for dividing all numbers to 50 and even numbers to 100, with the exception of 96T. Index chart shows all divisions obtainable to 380.

Model AU 11" Swing Dividing Head Fully Universal for complete indexing and spiral cutting . . . $242.00

Model BP 11" Swing Universal Dividing Head for plain milling machines . . . $168.00

Model SD 6½" Swing Universal Dividing Head for Smaller Milling Machines (Illustrated) . . . $105.50

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products
L-W CHUCK COMPANY
25 SO. ST. CLAIR ST.
TOLEDO 4, OHIO

"The Outstanding Basic Improvement in FLEXIBLE SHAFT Machinery in 25 Years"

The NEW Strand Rotoflex 4-speed gear drive Flexible Shaft Machine (shown upper right) is another step forward in Strand quality precision tools for faster, easier, more economical production work. The Rotoflex 4-speed gear drive employs a patented, new type of quick change gear drive utilizing 4 positive speeds by a unique and easy method of instantly changing from one speed to another. Rotoflex machines are powered with totally enclosed ball-bearing motors having speeds from 850 to 9000 R.P.M., depending on motor.

Standard type Strand machines, (lower right) give portable rotary power at constant speeds with dependable results in all grinding, buffing, drilling, wire brushing and rotary filing operations. Hundreds of types and models from ⅛ to 3 H.P. available with suitable attachments for your specific requirements.

Distributors in all principal cities
Ask for Bulletin No. 43 and Catalog No. 30

Strand

N. A. STRAND & CO.
5009 NO. WOLCOTT AVE.
CHICAGO 40, ILL.

NEW PROVISION FOR **PRECISION** ON MULTIPLE SPINDLE MACHINES

Scully-Jones Micro-Nut used on Adjustable Adapter in Multiple Spindle—Note Mark on Spindle to Facilitate Accurate Adjustment.
Graduated to permit Adjustment to within .001.
Set-Screw Does Not Touch Threads—Prevents Thread Damage.

SCULLY-JONES

MICRO-NUTS*

You make "Precision" Adjustments—Now you can make really accurate adjustments on Multiple Spindle Machines to .001 in., by scribing a mark at any point on the Spindle (see illustration) and turning the easy-to-read, calibrated Scully-Jones Micro-Nut in the direction required.

You Save Set-Up Time—You simply give a quarter-turn to the set-screw, to lock Scully-Jones Micro-Nuts in place at any location on the thread of the Adapter. Note diagram showing that screw *does not touch* threads.

Keep Inventory Down—Your requirements will be filled immediately from our stock of the following popular sizes, in "Acme" thread: 3/4", 1" and 1-1/16". A complete stock of all sizes for Adapters with "Acme" and "V" threads will be available Jan. 1, 1949. Write for bulletin giving further details and prices.

*Patent applied for R-2847

For Both Types of Threaded Adapters—You can use these low-cost Micro-Nuts on your present Adapters with or without set-screw slots.

Make Same Range of Adjustments—You can make the same range of adjustments, between spindle and work, with Scully-Jones Micro-Nuts as you do with standard solid adapter nuts.

Nothing to Get Out of Order—You will like the simple, trouble-free one-piece design, with vapor blast finish. Scully-Jones Micro-Nuts are machined and hardened to our high quality specifications, to assure you the service demanded by modern, high-speed production.

Scully-Jones AND COMPANY

1902 S. ROCKWELL ST.
CHICAGO 8, ILLINOIS

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

KUX

EXPERTS AT

CAM

CUTTING and GRINDING

The largest, most completely equipped plant in the country devoted to CAM cutting and grinding is at your service. 25 YEARS of experience in making special cams for thousands of companies has made us experts at cam cutting and grinding. Our facilities and equipment, finest in the country, permit us to manufacture any style or size Cam, Geneva Motion or Scroll Plate in quantities of 1, 10 or 10,000. Accuracy can be maintained to split thousandths, and surfaces to micro-finishes. Send us specifications or blueprints and we wil' be glad to submit a detailed quotation on your requirements.

KUX MACHINE COMPANY

3924 WEST HARRISON STREET • CHICAGO 24, ILLINOIS

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LOOK IT UP IN SWEET'S....

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Distribution Dept.
119 West 40 St., New York 18, N. Y.

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Firthaloy Dies

Will draw any shape

EASILY, FAST, ECONOMICALLY

"THE STANDARD CARBIDE"

- Recognized high quality of Firthaloy carbide grades assures greater wear resistance—longer life.
- Correct designing and a complete line of grades provide "tailor-made" dies to fit your exacting requirements.
- High standard of workmanship insures accurately made and better finished products.

FIRTHALOY SHAPE DIES

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First Fully AUTOMATIC LOADER For Gear Shaving Machines

● The Red Ring Automatic Loader, the first practical unit of its kind to be developed, has greatly increased the economy of the gear shaving operation. Equipped with such loaders, a battery of shaving machines can be kept in continuous operation by one man whose only duty is to keep their magazines loaded with work gears. That requires no skill.

Loading, clamping, shaving, unclamping, unloading and the final discharge of the finished gear are all automatic and fully protected by a safety mechanism. This is another significant accomplishment by the Red Ring organization which is today the world's largest manufacturer of gear shaving equipment.

The gear shown in the illustration here is an overdrive transmission planet pinion having 12 teeth, 13.5 D.P., 20° P.A., 1″ P.D. and a 1″ face. Actual shaving time is 11 seconds, loading and unloading 2.3 seconds or a total of 13.3 seconds for the complete cycle. This gives a production of 270 parts per hour. Stock removal is .005″ over pins.

The Automatic Loader is applicable to Red Ring Shaving Machines GCV and GCU for automotive transmission gears or similar units. For further details and quotation, call a Red Ring Engineer.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

"World's Largest Producer of Gear Shaving Equipment"

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IN 8 HOURS

Removed by BARNESDRIL Automatic Coolant Separator on Grinding Operations

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BARNESDRIL Automatic Coolant Separators, installed on a battery of Landis Thread Grinders, have eliminated this maintenance problem and increased operating efficiency as much as 90%. A No. 4 Separator is installed on each machine and removes an average of 60 pounds of swarf from each machine every 8 hours. As a result, a constant supply of clean coolant is assured and both direct maintenance costs and valuable production time have been saved.

"TAILORED-SKIL by BARNESDRIL"

Capacity of this No. 4 Separator supplies 40 gallons of clean coolant per minute. Other models range from 5 to 100 gallons per minute. Check your requirements for maintenance and sludge removal. A BARNESDRIL Automatic Coolant Separator will improve machine performance and efficiency.

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BARNES DRILL CO.

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SELECT THE RIGHT WHEEL

AND SAVINGS WILL FOLLOW

Vitrified makes it possible to standardize on grinding wheels by offering a wide range of standard types which cover practically all wheels used on standard makes of grinding machines.

Selection of the right wheel for the work to be handled is simplified in the Vitrified catalog—a 65-page booklet which gives specific data, dimensions, etc., covering the entire Vitrified line.

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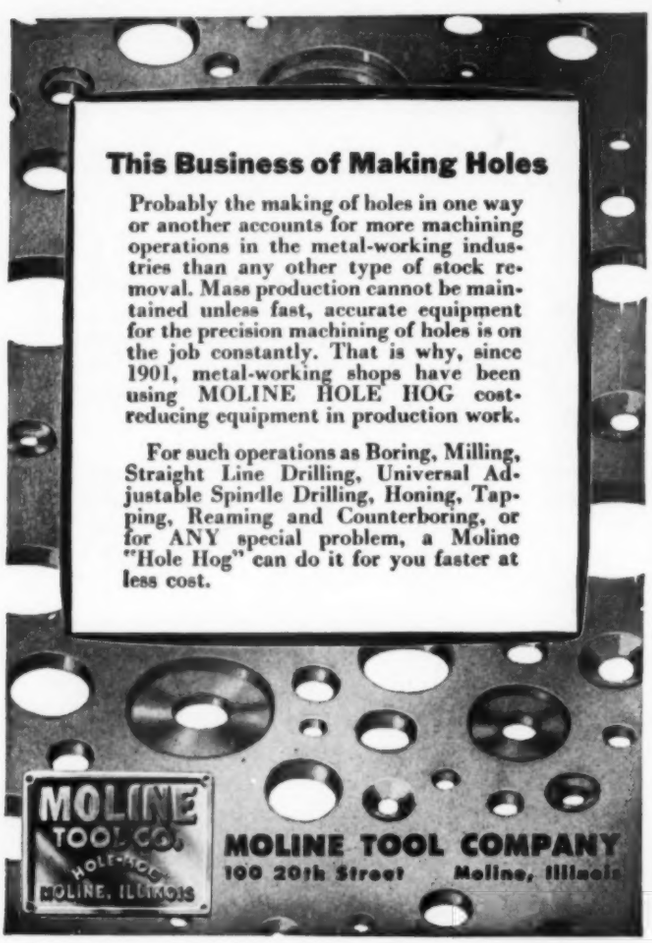
WESTFIELD MASS.



This Business of Making Holes

Probably the making of holes in one way or another accounts for more machining operations in the metal-working industries than any other type of stock removal. Mass production cannot be maintained unless fast, accurate equipment for the precision machining of holes is on the job constantly. That is why, since 1901, metal-working shops have been using MOLINE HOLE HOG cost-reducing equipment in production work.

For such operations as Boring, Milling, Straight Line Drilling, Universal Adjustable Spindle Drilling, Honing, Tapping, Reaming and Counterboring, or for ANY special problem, a Moline "Hole Hog" can do it for you faster at less cost.

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for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economicaly on these presses.

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of head, body and thread is assured in every Ottemiller Screw Machine Product because they're "Milled from the bar."

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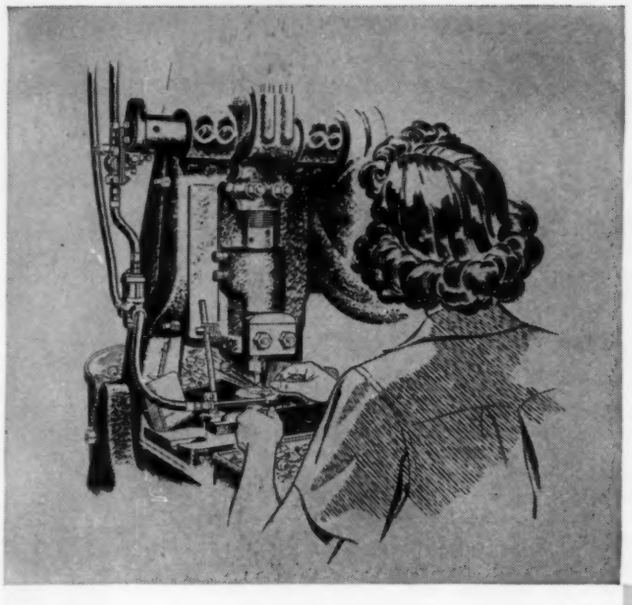

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Cost is amazingly LOW, production HIGH, and the job safer for the operator when Schrader Air Ejection Sets are used on your power presses or other machines where ejection of work is desirable.

Schrader Ejection Sets are available in boxed sets ready for quick installation. Several types are offered to cover the various phases of work. These types fit any Power Press or other machine that has a moving member from which to take actuation by a Cam or by a Sliding Tripper. This includes Simple or Compound Dies. Schrader Air Ejection Sets eliminate mechanical knockout—the hazard of removal of work by hand.

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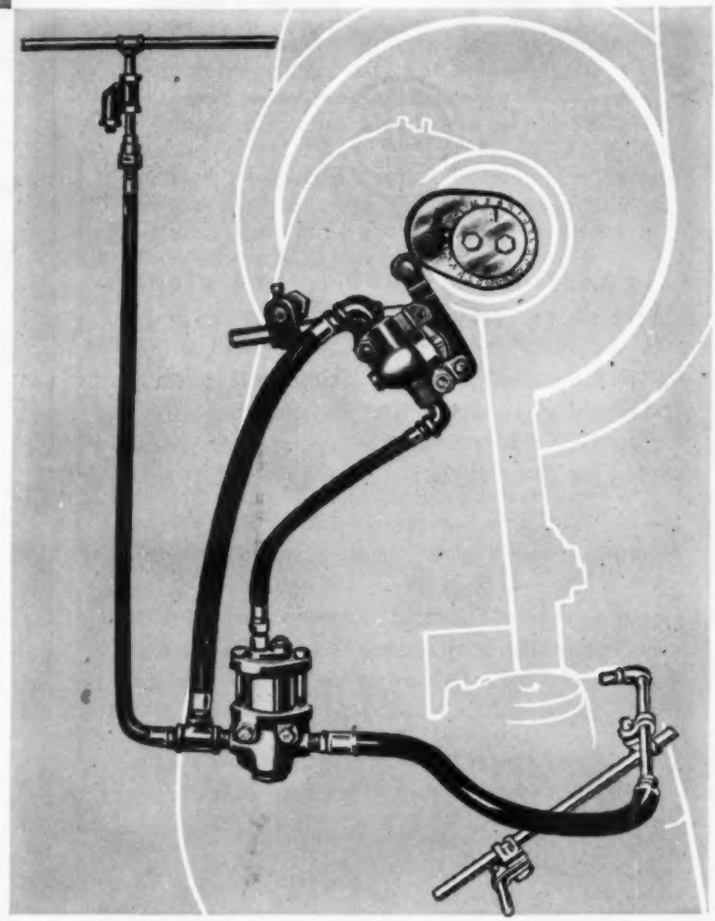

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Jig cost cut $15,000 in one plant
Another saves 800% in time

A "plant suggestion" to overcome a bottleneck in production led to the development of the Berger Jig Collimator. Invariably, where this scientific achievement has been employed, savings in time and money resulted.

No longer does the well-operated plant stretch piano wires as horizontal or vertical guides... no longer are constant corrections or allowances for stretch and oscillation necessary... no longer are delays and difficulties encountered because of buckling, sagging or snapping of wires. Relevel, change, check or inspect the structure anywhere at any time by using the Berger Collimator.

Basically, the answer is the projection of optical lines and the elimination of wires by the use of the Berger Collimator.

The Berger Collimator is indispensable equipment to save man hours and material cost. At the same time, it attains greater accuracy and flexibility — yet is so easy to use... only Berger instruments can achieve such a peak of perfection and precision.

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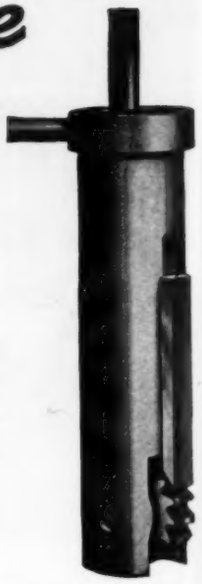
THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER on Your Work



Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

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In Specifying Drillheads . . . (P/C/D)* **CONSIDER THE (P/C/D) FACTORS**

When you install a Thriftmaster Multiple Spindle Drillhead in your production line, you have positive assurance that:

*It is a PRECISION tool which, while adjustable, locks in a rigidly fixed spindle location for accurate production.

*The high overload rating of Thriftmaster, guarantees many thousands of hours at full CAPACITY of the tool in steel.

*Rugged construction, plus full ball bearing mounting, will provide extreme DURABILITY and dependable service.

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THRIFTMASTER
Multiple Spindle Drillheads
FIXED AND ADJUSTABLE CENTERS

Breeze right through

TOUGH MILLING JOBS WITH KENT-OWENS MILLING MACHINES

Now is the time to "chart your course" to greater production and lower costs . . . with Kent-Owens Milling Machines!

Designed for *top-speed* and *accuracy* where the going is tough . . . ruggedly built . . . efficient . . . dependable. Especially, you'll like the many practical features of Kent-Owens Machines that save job-time and labor. Write for bulletins on the Kent-Owens Standard line . . . including wide range of hydraulic and hand operated machines. Also, let our engineers help you with special machine requirements. Kent-Owens Machine Co., Toledo, Ohio.

No. 1-14...52" x 9" table...14" table travel...hydraulic table feed...full automatic cycle.

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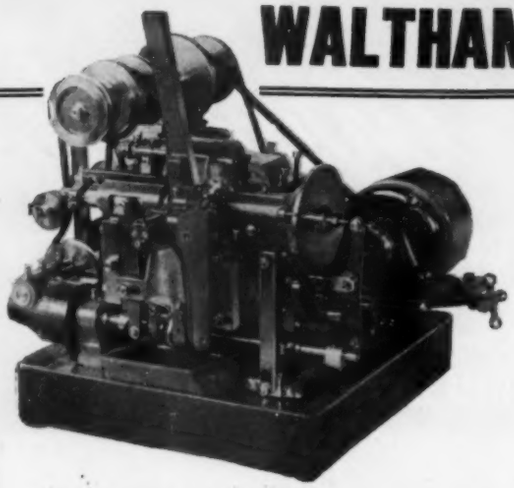
for Milling Machines

WALTHAM PINION and GEAR CUTTING MACHINES



Precision and Economy in Mass Production of Small Parts

Specially designed for high speeds and close accuracy, cutting straight teeth in fine pitch pinions, gears and small mechanisms, Waltham Machines are fast, convenient and time-proved on a wide range of work. In all types the same cutting method is employed, by which successive cuts are made by a revolving cutter, blanks being held and indexed by the work spindle. Special cutters furnished to customers' specifications.

Write for illustrated literature giving detailed description and specifications.

TYPES AVAILABLE

Single Cut Pinion Machines—employing one cutter
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BUILDING COMPLETE MACHINE TOOLS
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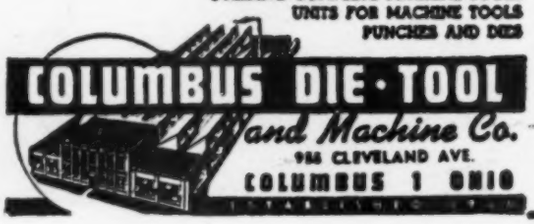

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HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

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• You can also use the Hovis Master Washer Die as a holder for making various blanks in your own die room, eliminating the cost of new die sets.

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IT'S THE ROTARY IMPACT THAT DOES IT

NO KICK
NO TWIST
EVEN ON THE TOUGHEST JOBS

AMAZING *all-purpose* ELECTRIC TOOL *will*

- Drill up to ¼" dia.
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(Uses Standard Attachments)

AMAZING! No Kick—No Twist—Even if you stall the spindle completely, the motor continues to run.

AMAZING! It's Reversible—full power in either direction—runs on 110V ac-dc.

AMAZING! It saves up to 90% of the time on nut-running operations alone.

AMAZING! With Standard Attachments you need only ONE INGERSOLL-RAND IMPACT TOOL to do all operations.

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JOHN BATH & CO., INC.

BECOMES A USER OF THE BLAKE FLUTE GRINDER

We are pleased that John Bath & Co., Inc., Worcester, Mass. can now be listed among the prominent tap makers who are using the Blake Flute Grinder either for spiral point or flute grinding.

Precision is important in many tap jobs today, and this machine is recognized as adding to the accuracy of even the highest grade taps.

We will be glad to send bulletins describing this machine and giving information about precision sharpening of taps, or to give the names of tap manufacturers in a position to supply taps sharpened on the Blake Flute Grinder, to anyone interested.

EDWARD BLAKE COMPANY A.M.
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Please send me Catalog and full details on BLAKE FLUTE GRINDERS.

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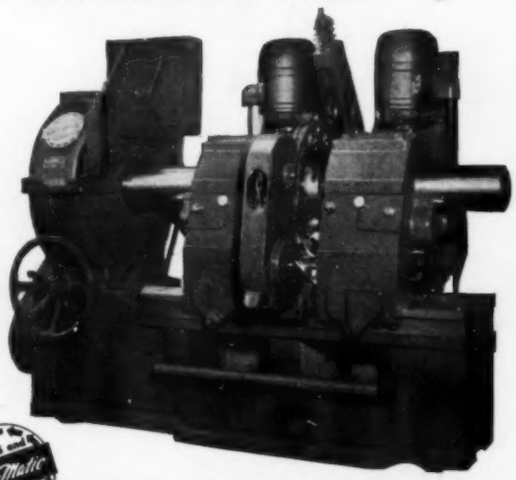
BLACK DIAMOND PRECISION DRILL GRINDERS • BLAKE TAP GRINDERS • BLAKE FLUTE GRINDERS • WALTHAM CUTTER SHARPENERS • WALTHAM THREAD MILLERS • AMERICAN TOOL HOLDERS • SURFACE FINISH STANDARDS

Roto 1-A Matic

HORIZONTAL PRODUCTION MILLERS

FEATURING

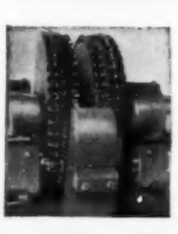
1 CONTINUOUS OPERATION
2 AUTOMATIC CHAIN CLAMPING
3 ROUGH & FINISH CUTTERS — EACH HEAD
4 3 TYPES — VARYING BED LENGTHS
5 LOW MAINTENANCE COST
6 INTERCHANGEABLE FIXTURES



INDEPENDENTLY DRIVEN HEADS

No. 1-A ROTO-MATIC Millers have been produced for the past 30 years in various sizes and types to do specific jobs faster and better than they have ever been done before. Because of their flexibility they have been designed to take a wide range of work with uniform satisfactory results. Engineering has made possible the milling of several work pieces at one time giving a high production of each. In all cases exacting requirements as to quality of work have been met.

Chain Clamping Fixture for rough and finish milling both ends of Control Arm Trunions to length. Interchangeable buttons make possible the milling of several sizes — Production 296 gross per hour.



Double Chain Clamping Fixture with a total of 28 stations for milling ends of Clutch Gears — Production 200 gross per hour — With this arrangement two different parts can be milled simultaneously.

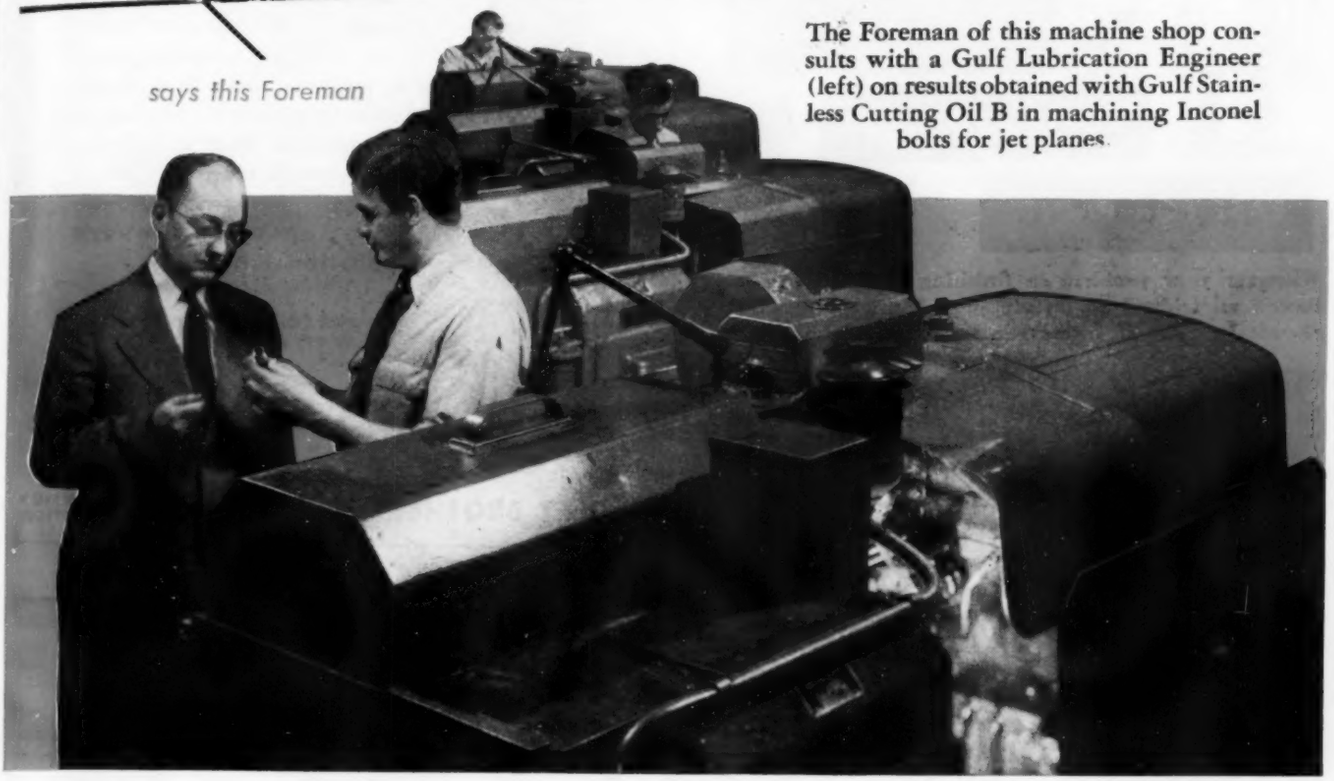
Double Drum — 50 automatic holding fixtures on each drum for rough and finish milling radius on Rocker Arms — Production 1400 gross per hour.

ASK FOR BULLETIN 121

DAVIS and THOMPSON CO.
MANUFACTURERS OF *Machine Tools*
MILWAUKEE 14, WISCONSIN

"With **Gulf Stainless Cutting Oil B** we increased production and tool life"

says this Foreman



The Foreman of this machine shop consults with a Gulf Lubrication Engineer (left) on results obtained with Gulf Stainless Cutting Oil B in machining Inconel bolts for jet planes.

"Use of this quality dual-purpose oil means the difference between profit and a loss for us in machining Inconel bolts."

"Gulf Stainless Cutting Oil B helped us solve a tough problem in machining jet aircraft bolts of Inconel X," says this Foreman. "Before we used this quality cutting oil, we could produce only 15 to 18 pieces before regrinding the tools."

"Now with Gulf Stainless Cutting Oil B, we often run as many as 150 pieces without touching the tools. Use of this cutting oil means the difference between making money on the job and a heavy loss."

A typical report from the scores of plants which have improved production and tool life through the use of Gulf Stainless Cutting Oil B. In addition to its outstanding performance as a cutting oil, Gulf Stainless Cutting Oil B also provides excellent lubrication for the working parts of machine tools. Thus it serves as an ideal dual-purpose oil in machines using one oil as both lubricant and cutting oil. This quality oil is non-corrosive to finished metal surfaces.

Ask a Gulf Lubrication Engineer to demonstrate the advantages of Gulf Stainless Cutting Oil B and other quality cutting oils in the complete Gulf line in your shop. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

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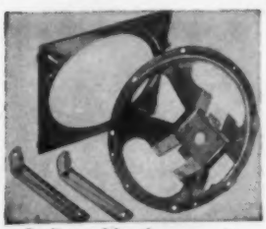
Whatever your problem in finishing zinc or cadmium, there's an Iridite* to do the job. Iridite, a quick-dip, chemical treatment, offers you these three advantages—



Radio and hardware parts, permanently brightened with Iridite.

1. EYE APPEALING FINISH

On plated parts Iridite forms a long lasting, sparkling *bright* finish that *stays bright*, even after handling, storage, exposure. On all surfaces, Iridite can be used to produce a variety of colored finishes.

Wire cloth and galvanized bucket, Iridited for extreme corrosion-resistance.

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Resistant to the attack of water, gasoline, and ordinary corrosive conditions, Iridite provides the ideal *final finish* for all zinc and cadmium surfaces.

Hardware products, Iridited and painted for peak finishing system efficiency.

3. BASE FOR PAINT . . .

On any zinc or cadmium surface that must be painted, Iridite insures a better finishing system because the coating improves initial paint adherence, blocks corrosion *under* paint, blocks formation of metallic soaps *between* paint and metal.

● **Tell us the type of finish you need for zinc or cadmium—let us tell you how Iridite can help. For information and samples, write to:**

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Fundamental standards—length, mass and time—are determined by comparison with measurements set by statute. There are no such "standards" to measure hardness. But . . .

After a "ROCKWELL" Hardness Tester leaves our Standardizing Laboratory, it is perfectly capable of setting and maintaining its own standard, according to the universally accepted "ROCKWELL" Hardness scale.

Remember, the "ROCKWELL" Hardness Tester is made only by Wilson. And Wilson makes only hardness testers.

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to the uses for HANSEN COUPLINGS

NEEDED IN EVERY FLUID LINE

Economies are created in every plant by the use of HANSEN couplings in fluid lines. The quick-connective and shut-off features of these couplings save you time and money, and the variety of jobs they do is endless.

HANSEN couplings make connections and change-overs a matter of seconds. Costly operations are not interrupted . . . equipment continues to produce. Connection is made by pushing plug into socket . . . flow starts at once, automatically. Slight movement of the socket sleeve releases plug, and supply line is immediately sealed . . . one-way or two-way shut-off. For applications where no closure is desired, a "straight through" series has been designed.

Each HANSEN coupling is engineered for the service for which it is recommended, and there is no limit to the uses for HANSEN couplings in these services.

Write for Industrial Catalog No. 47

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QUICK CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

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Men trained to do one job well. A factory tuned to single-minded production.

No matter what machine you use or what material you cut . . . it may pay you well to consult the leading cutting wheel *specialists*. The usual story is lower wheel costs . . . better product . . . maximum machine output.

CALL AN *Allison* ABRASIVE CUTTING EXPERT

Allison WHEELS

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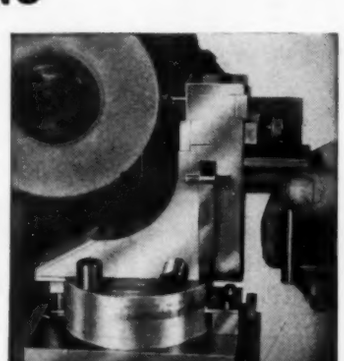
256 ISLAND BROOK AVENUE BRIDGEPORT 5, CONN.

THE ALLISON COMPANY

★ ★ ★ *Fluidmotion*

Simplest and most accurate method of

FORM-DRESSING



● "Fluidmotion" Wheel Dressers generate wheel profiles in such a way that angles and radii flow into each other, without sharp changes of direction. Two angles and a radius can be dressed in one continuous motion—after only one setting of the dresser. "Fluidmotion" Dressers are made of the finest chromium-molybdenum-vanadium alloy steels and have no wearing surfaces, as the gibs and V ways are positioning surfaces only and the dresser swivels on completely dust-protected ball bearings. Several models available. Model F, illustrated, is the smallest. 5" height to diamond center, dresses wheels up to 7" in diameter, profile radius up to 2". Write for booklet.

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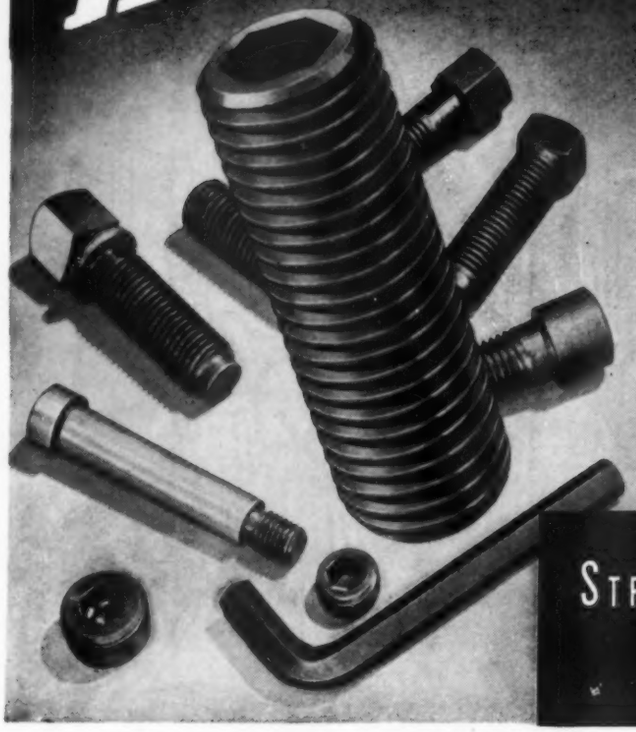

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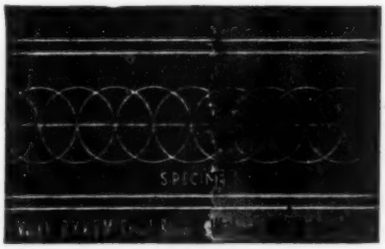

Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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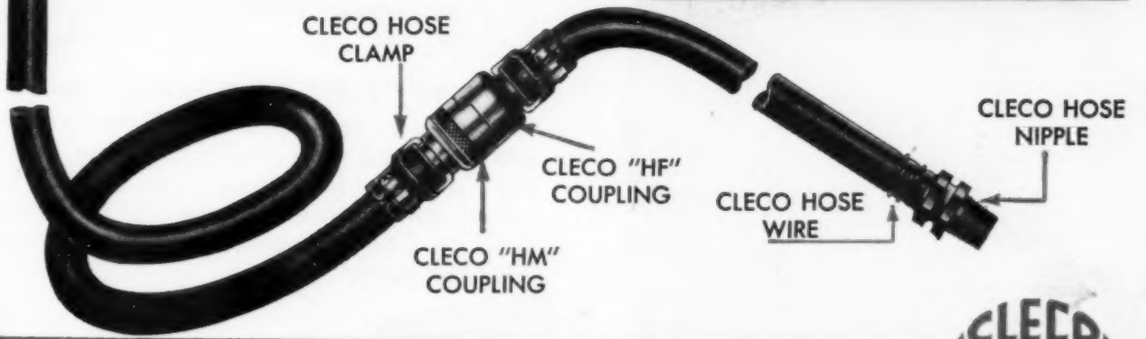

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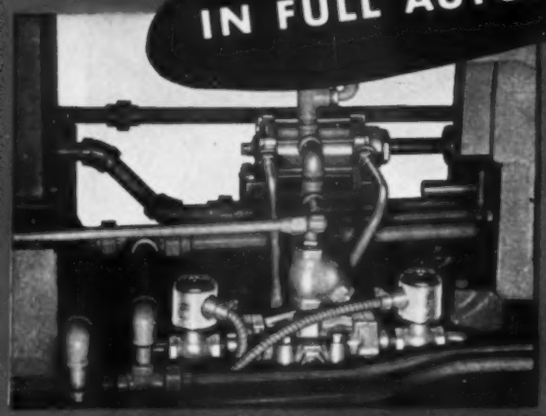
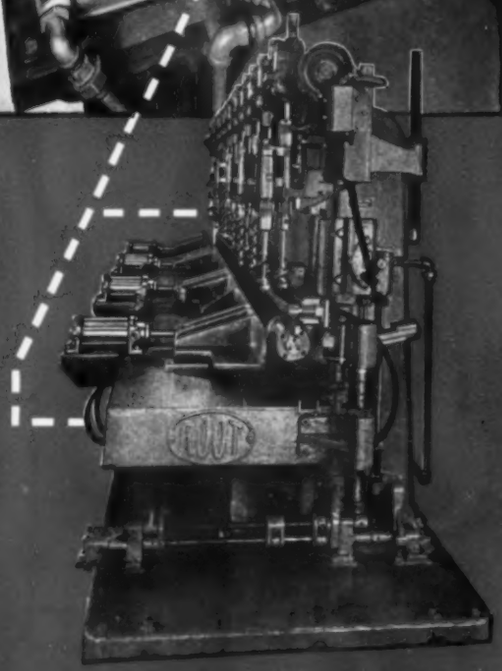
IN FULL AUTOMATIC CYCLE ON SPECIAL MACHINE





Photos courtesy of B. M. Root Co., York, Pa.

All movements of this special machine are automatically controlled in sequence by means of two Logan solenoid air valves of the bleeder-operated type. The cycle is as follows:

1 The work moves through a channel until it strikes the end stop and trips an electric control switch.

2 *One* Logan electric solenoid operated air valve activates *four* Logan air cylinders simultaneously to clamp the work. At the end of the clamping movement, a cam trips an electric limit switch (center photo).

3 A second Logan electric solenoid operated air valve then activates the fifth Logan air cylinder (top photo), automatically starting the foot trips which control the hydraulic table feed.

4 The table moves upward, feeding the work to the cutters. Multiple wood boring operations are performed simultaneously on telegraph pole cross arms.

5 As the table feed movement is completed, another limit switch is tripped, and the second air valve reverses the table movement. This trips still another limit switch, operating the first air valve and releasing the clamping fixture so the workpiece can be unloaded.

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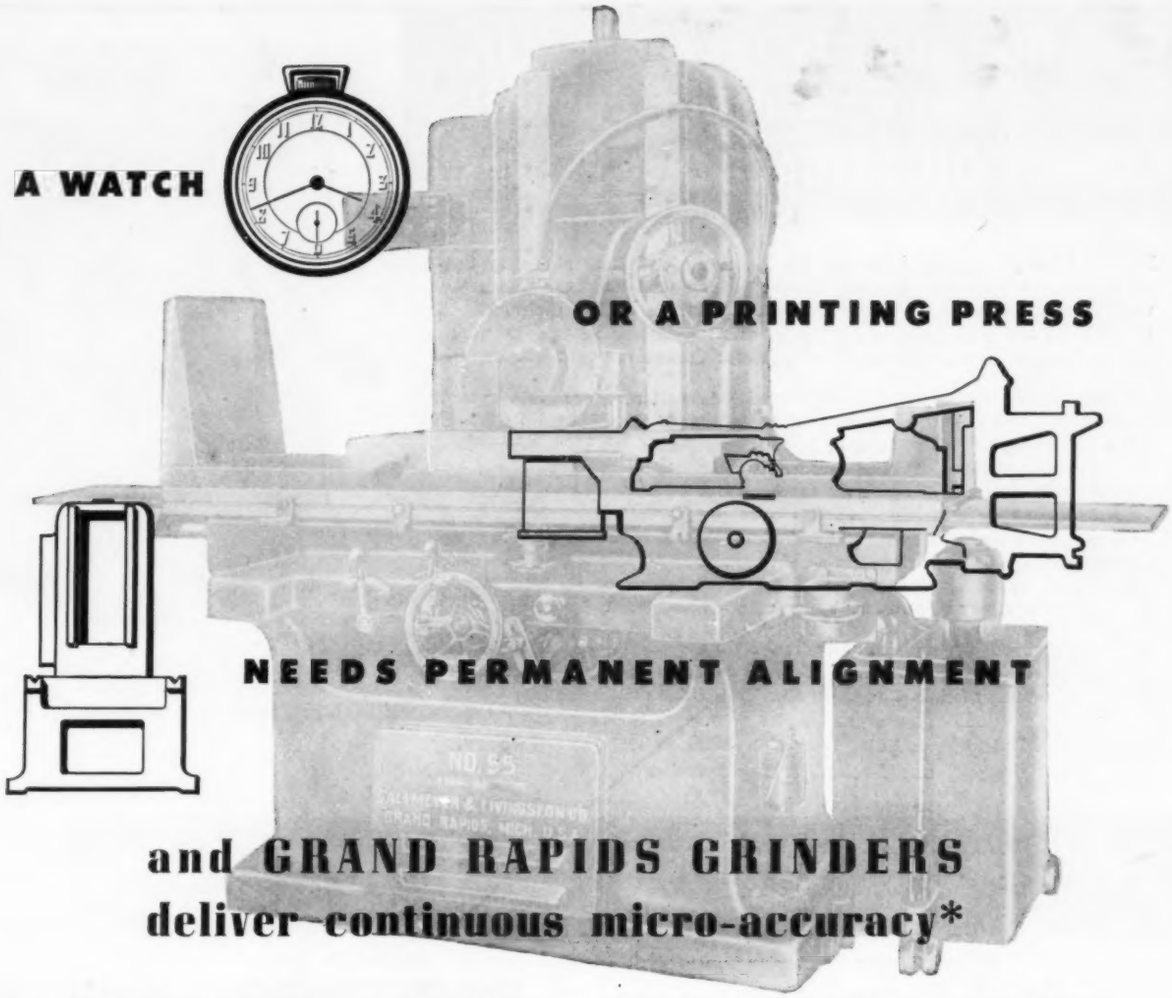

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*accuracy within 0.00025 limits.

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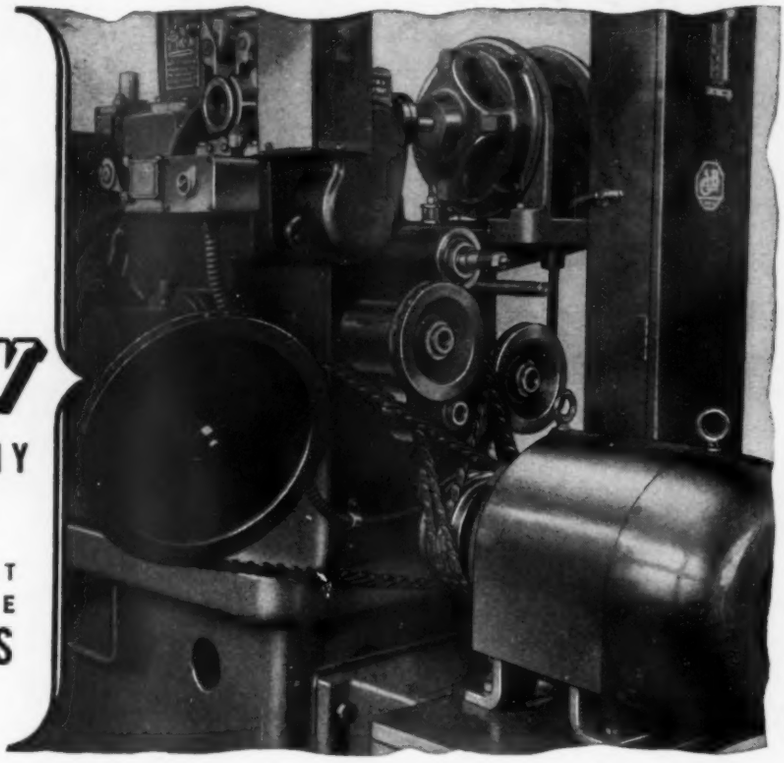

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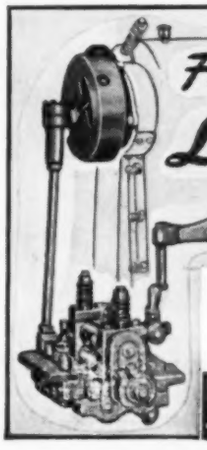

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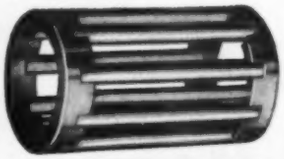

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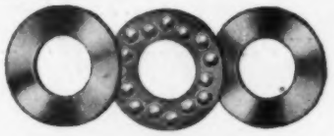

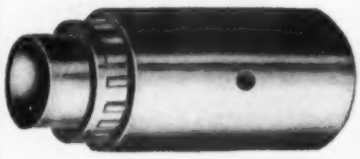

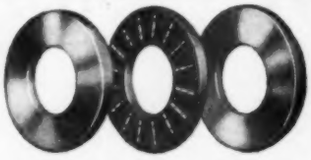

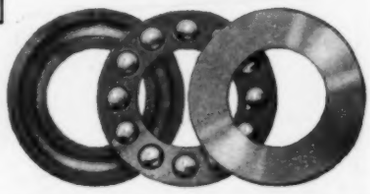

THE ERRINGTON
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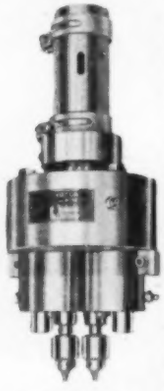
EXTENDED



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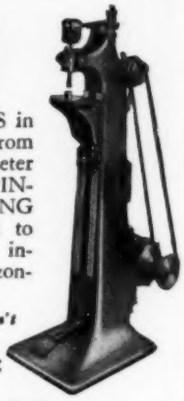

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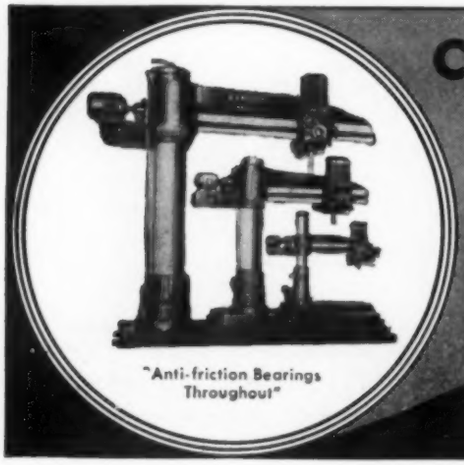

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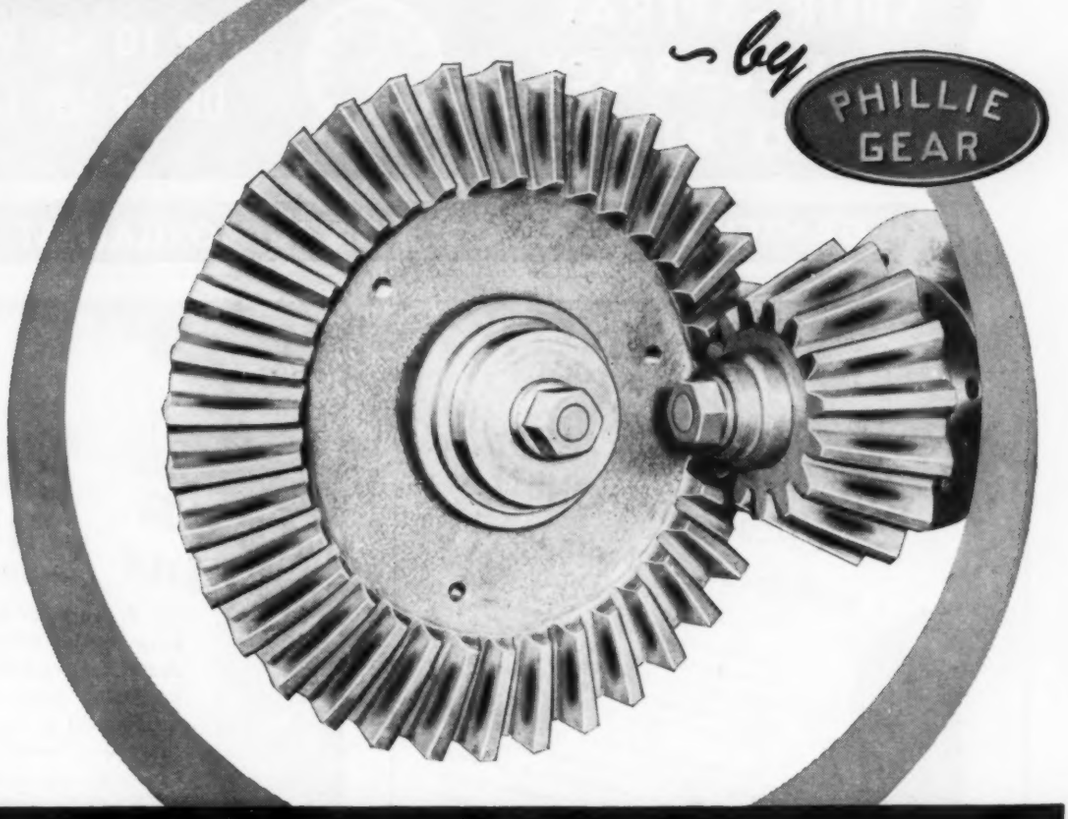

. . . COMBINE LOCALIZED TOOTH CONTACT OF SPIRAL-BEVEL GEARS WITH LOW THRUST LOADS OF STRAIGHT-BEVEL GEARS

Actually, "Zerols" are curved tooth Spiral-Bevel gears, with zero degree spiral angle. ***Localized tooth contact*** gives smoothness, quietness and strength, — even under very high loads, — so, "Zerols" are replacing straight bevel gears in many applications where thrust limitations prevent the use of spiral-bevel gears.

Like straight bevel gears, "Zerol" gears have the advantage of no inward axial thrust under any conditions. In fact, with zero-degree spiral angle, the thrust loads are the same as for equivalent straight bevel gears, — so "Zerols" can be substituted for straight bevel gears, without change in thrust bearings.

"Zerol" gears, like other bevel gears, are designed with long and short addendum tooth proportions for smooth, quiet operation, and with large fillet radii for maximum strength. Large "Zerols," when required, have their teeth (only) hardened on our own surface hardening machine, while smaller ones, where necessary, are hardened by the induction, straight heat treating, or case hardening methods. "Zerols" decrease stress, greatly lengthen gear life, and minimize breakage.

We are in a position to cut gears of the "Zerol" bevel type up to 48" in diameter. Write us for further information.

"For Over 56 Years, Manufacturers of Gears and Gear Products"

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SPUR—SPIRAL
BEVEL—RACK
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UP TO 60" PITCH DIA.
UP TO 10" FACE WIDTH

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Cincinnati Coniflex gears make possible wider operating tolerance . . . allowing slight deflections in operation without dangerous concentration of the load at the ends of the teeth.

For smoother, quieter operation . . . and where performance must be "RIGHT" . . . localization of tooth contact in Cincinnati Coniflex Gears insures a good tooth bearing under operating loads.

★ SPUR
★ BEVEL
★ HELICAL
★ SPLINE
★ WORM
★ SPECIAL

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The Braun Gear Company has been shaping the wheels of industry for more than 38 years, producing gears of quality at economical prices. The large, thoroughly modern Braun plant is now more than ever equipped to supply the things that count in gears—precision workmanship, fine materials, good design, and prompt service.

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Create Production Advantages
43 Years' Experience
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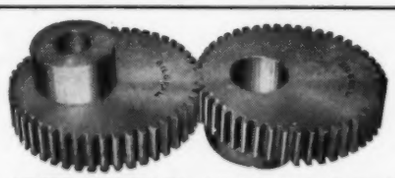

ELLIPTICAL GEARS
Also Other Non-Circular Gears

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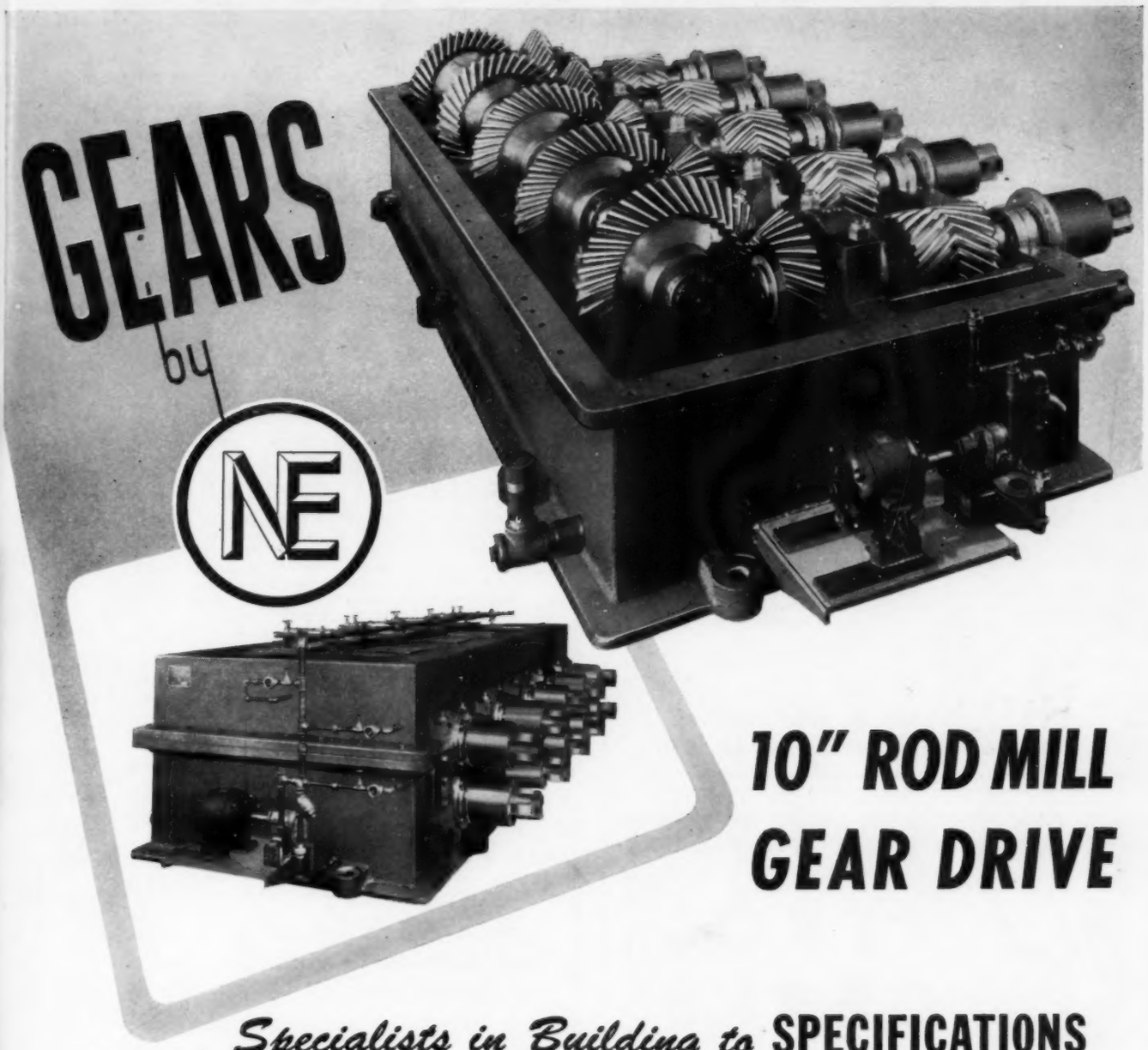

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Specialists in Building to SPECIFICATIONS

THIS special gear drive for the last five finishing stands on a 10" rod mill was fabricated here at NE from specifications and prints furnished by the customer. The main drive motor is 500 HP, 500 RPM and the velocity of the spiral bevel gears approximates 4500 feet per minute. Anti friction bearings throughout with gears and bearings lubricated from a central oil system assure smooth power from this 37,588 pound mechanism. This sort of work is common practice at NE. It is accomplished with one control and one responsibility here within the walls of our own foundries and machine shops. Your requirements for steel castings and gears or finished mechanisms for application to the machines of industry will merit our complete attention and best advice. Consult with us.

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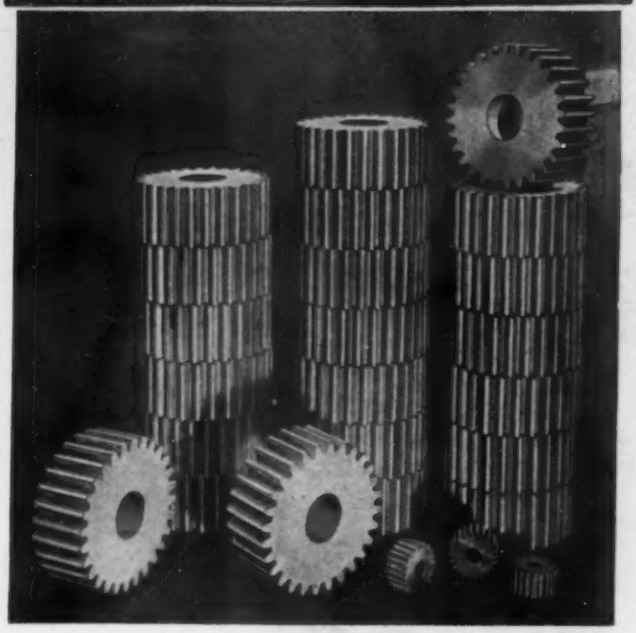

Get a Stahl estimate whenever you need non-metallic gears. We have long been specialists in this type of gear production, and are equipped to produce on short order bakelite, fabroil, or rawhide pinions . . . in all sizes.
In addition, we are able to give prompt service on metallic gears of all types—spurs up to 6' in diameter; other sizes in proportion.

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ARMORED GEARS
Reg. U. S. Pat. Off.

JUST THE RIGHT HARDNESS IN JUST THE RIGHT PLACES, PLUS A TOUGH, SHOCK-RESISTANT CORE.

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AGAINST BREAKAGE AND WEAR

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WORMS—Milled up to 12" dia.—up to 1 D.P.

WORM GEARS—Generated up to 108" dia.—up to 1 D.P.

HERRINGBONE GEARS—up to 60" P.D. 18" face, 2 D.P.

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HELICAL GEARS—Ground tooth up to 14" dia., 6" face, 2 D.P.

SPUR OR HELICAL GEARS—Shaved tooth up to 20" dia., 8" face, 2 D.P.

SPUR GEARS—Form Cut—to 96" dia., 24" face—up to 4" C.P.

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SPUR GEARS—Fellows Generated—to 140" dia., 8" face, up to 1 D.P.

SPUR GEARS—Ground tooth up to 18" dia., 12" face—2 D.P.

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ACME SCREWS—Milled up to 6" dia. 30 ft. length

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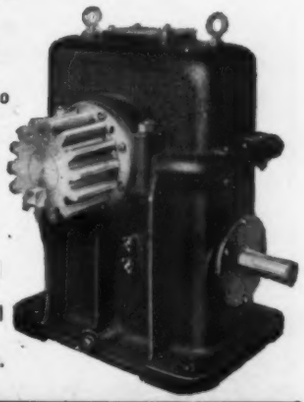

WORM GEAR—Ratios 3⅝ to 60 to 1, Single, Double Reductions up to 10,000 to 1.

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GYRO—Ratios 24 to 1 to 3600 to 1

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YOU FURNISH THE SPECIFICATIONS • WE'LL PRODUCE THE GEARS

PERKINS *precision,*

Perkins Makes—in all materials, metallic & non-metallic
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***custom-cut* GEARS**

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"...Might be if you have become deadened to production headaches. Personally, I've found cutting fluids are a major factor in operating a modern metal working plant. They can make or break most jobs. And that's not hard to understand when you consider all the variables involved. Speeds, feeds, materials, tolerance and finish requirements all influence the application of a cutting fluid. Oil that is 'just oil' simply cannot give you the performance you need. Fortunately, it is a problem that can be satisfactorily solved by *qualified* cutting oil people. It's their full-time business. They have the experience plus the facilities that no individual user can match. I've learned that it pays to take advantage, not only of their tested products, but of their experience and service as well."

—Chip

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How costs were cut by *STITCHING* rubber to aluminum

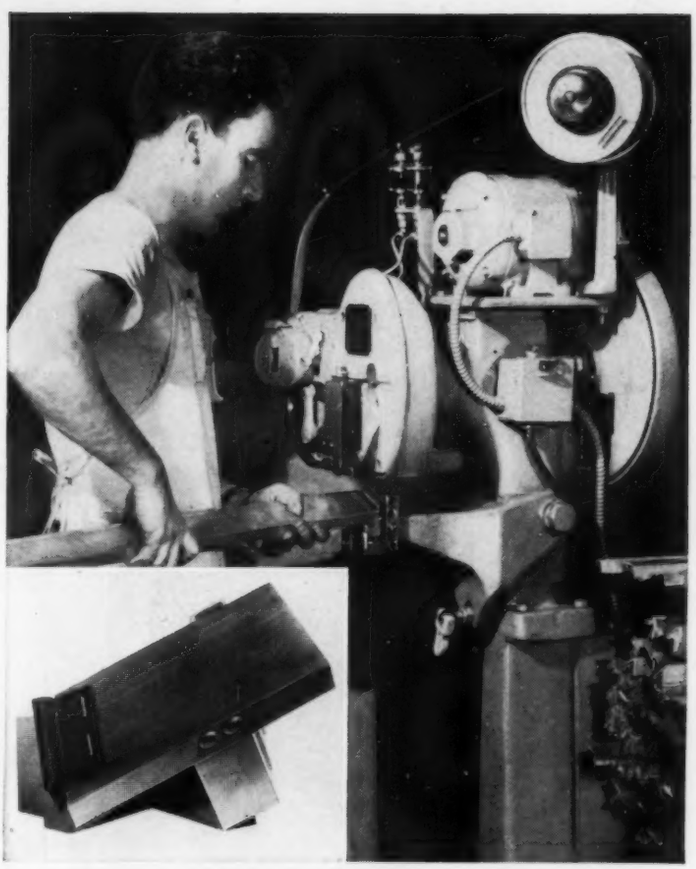
with the ACME-MORRISON Metal Stitcher

Savings in time, money, and materials have been brought about through the use of an Acme-Morrison Metal Stitcher in attaching rubber feet to aluminum ladder legs. That's the report that comes from Bardwell & McAlister Inc. of Burbank, California.

"We have realized a saving," the firm says, "of approximately two minutes' assembly labor per ladder over the old method of bolting; a saving of the cost of four screws, nuts and washers; and an increase in the strength and rigidity of the joint."

In a single operation the Acme-Morrison Metal Stitcher forms its own stitch (or staple), drives it through the material and clinches it. In this particular case, the stitch penetrated 1/4 inch of rubber and 3/32 inch of aluminum.

Acme-Morrison Metal Stitchers are made in several models. They will stitch aluminum, steel, copper, brass, bronze, certain grades of stainless steel, cork, asbestos, rubber, wood, and canvas. Why not find out what these time and money-saving machines can do for your business. Mail the coupon today.



Stitching a rubber foot to an aluminum ladder leg in the Bardwell & McAlister plant, Burbank, California. Inset shows how the stitches fasten the rubber to the metal neatly and securely.

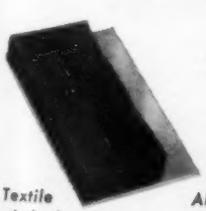
Cross-section view of a stitch

STITCHING WIRE DIVISION

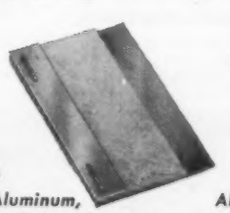
ACME STEEL COMPANY

NEW YORK 17 ATLANTA CHICAGO 8 LOS ANGELES 11

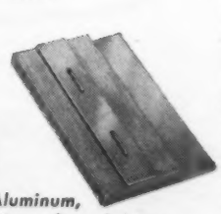
A few of many combinations



Textile stitched to aluminum



Aluminum, leather and copper stitched together



Aluminum, plywood and brass stitched together

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Gentlemen:

Please send me further details about the Metal Stitcher.

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Company_____

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Here is a 6" x 18" Permanent Magnetic Chuck, ***Walker*** patent, ready for one of these unique applications.

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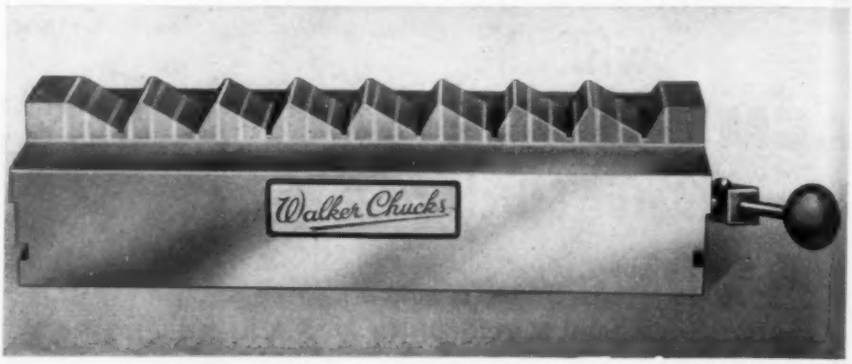

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Original Designers and Builders of Magnetic Chucks

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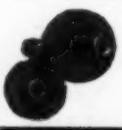
Los Angeles: *A. C. Behringer, 324 N. San Pedro St., San Francisco; Guy Reynolds, 464 Vernon St., Oakland.* **Canada:** *F. Barber Machinery Co., Toronto, Canada.*



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Send samples or blueprints for quotation

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Semi-skilled operators will deliver high production accurately, efficiently, with a minimum of supervision.

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Controlled by a Master Hand

The OLIVER TOOL BIT GRINDER

Template-controlled for sharpening of all single-point tools, the Oliver Tool Bit Grinder grinds all flats and radii of the tool in one operation—then repeats, as if controlled by a master hand, on the next tool!

Designed for production sharpening of Tungsten-Carbide and high speed tools, this grinder (10" model shown) has a capacity for tools up to 1" wide by 1¾" high, and from 0° to 20° clearance. A two-horsepower motor provides sufficient power for the heaviest cuts. The 10" model grinds on the face of a 10" wheel.

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IT'S THE BACKBONE
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No seams, slivers or other surface physical defects can hide from *this* searching test. And it's just one of many! Chase wire for cold-headed products is also subjected to a compressing or upsetting test that simulates a very severe heading operation.

In addition, Chase wire must be uniform in surface texture and color, have accurate dimensions, be precisely tempered. And there's a Chase copper-alloy wire for *every need!* Write the nearest Chase Warehouse or Service Office, and be *sure* of the best.

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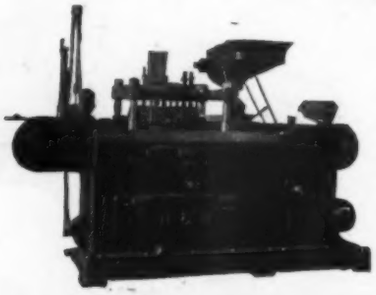
A Special Dieing Machine can be TAILORED to YOUR REQUIREMENTS



PRIMER-INSERTING

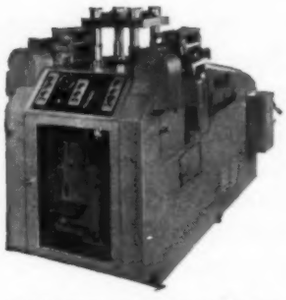
A difficult problem is met by this machine, at great savings, performing 7 operations complete - per - stroke, including varnishing.

OUR REGULAR MODELS FIT THE MAJORITY OF REQUIREMENTS

STANDARD

Capacities: 10 tons to 300 tons. Combining blanking, piercing, forming, drawing, coining, extruding, broaching, etc., in pieces produced complete-per-stroke at speeds up to 600 s. p. m.

SPEEDMASTER



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These 3 precision machine tools are a necessary part of every completely tooled shop . . . a modern precision lathe with "Zero Precision" tapered roller bearings that will retain its extreme accuracy at new high operating speeds . . . a convenient back-geared shaper that embodies all major improvements . . . a capable small milling machine that will do accurate work . . . all three are extremely moderate in price.

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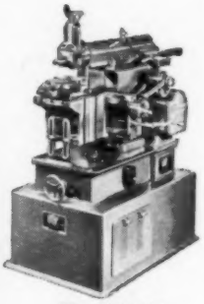
No. 3000A Size "O" Milling Machine

No. TRBS-56 11" Lathe 1" Collet capacity



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Outside cutter of Disston D-15 Dado

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Deep hardening, Non-deforming, Uniform

Die and punch of Mansil Tool Steel used in the making of 5½″ dia. Dado cutters from annealed 53-75 steel containing .70/.85 carbon and .61/.80 manganese. Raw material is .109″ thick, finished .093″.

Disston Mansil Tool Steel is one of the most dependable tool steels ever produced. You can rely fully upon it in forging, machining, grinding and heat treatment. Exceptionally well suited for making intricate shapes and wherever varied cross sections must be deeply hardened.

Because of its non-deforming characteristics in hardening, good machinability and long life, Mansil Tool Steel is specified for blanking and forming dies used in the production of thousands of steel specialties. It can be annealed very soft, with small, well spheroidized carbides. Upon correct heat treatment, this structure changes to a fine martinsite . . . the fracture grain, too, will be fine, ranging from 9 to 10 Shepard.

Use Mansil Tool Steel for dies, punches, broaches, forming shears, gauges, hobs, reamers, taps, test plugs, master tools and similar applications.

ANALYSIS OF MANSIL TOOL STEEL

Carbon	.90%	Chromium	.50%
Manganese	1.15%	Tungsten	.50%

DISSTON ENGINEERS AND METALLURGISTS will be glad to help you solve any of your tool steel problems.

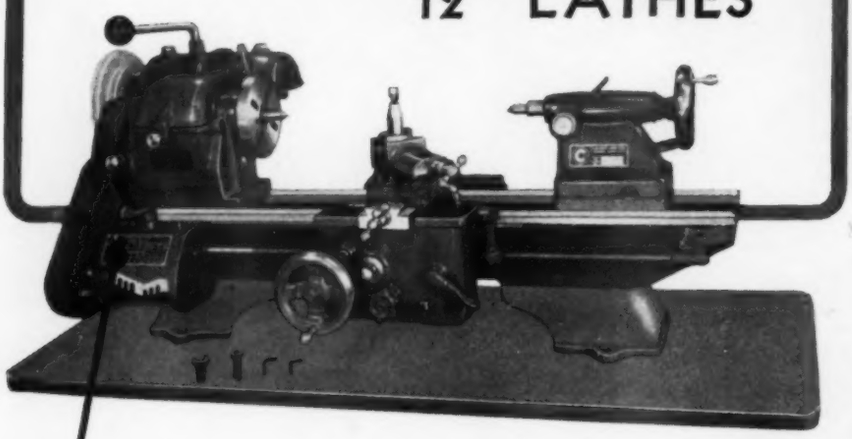
WHEN YOU BUY A DISSTON PRODUCT YOU BUY *DISSTON* STEEL SKILL and SERVICE

STEEL—Everybody who wants to obtain steel can help himself to get it by immediately starting scrap into the channels that serve steel mills.

HENRY DISSTON & SONS, INC., 820 Tacony, Philadelphia 35, Pa., U. S. A

Clausing

DUAL QUICK CHANGE 12" LATHES



48 THREADS AND POWER FEEDS AT YOUR FINGERTIPS

Designed for wide range performance and utmost ease of operation. The Clausing Dual Quick Change 12" Lathe gives instant selection of 48 threads and feeds . . . simply by shifting two levers. Gives finer feeds instantly without stopping lathe. Saves set-up time and operating time on any turning operation requiring power feed. Easy-to-read chart shows lever and gear positions. The Synchronized Gear Box is of "big machine" design and construction. Liberal use of precision ball bearings on which shafts turn readily, with a minimum of friction. Gears are machine cut, ½" wide for greater strength and longer life. Compare the Clausing Quick Change with lathes in this price range.

ADDITIONAL Clausing FEATURES

Precision ground bed with two flat and two vee ways . . . Adjustable Timken tapered roller bearing headstock . . . Ball bearing friction clutch countershaft . . . Nine spindle speeds from 33 to 2400 r.p.m. . . . Hooded V-belt drive . . . Automatic apron . . .

For smooth, accurate performance, greater convenience and lasting satisfaction investigate Clausing Lathes today.

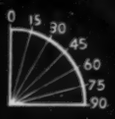
CLAUSING MANUFACTURING CO.

227 RICHMOND AVE. OTTUMWA, IOWA

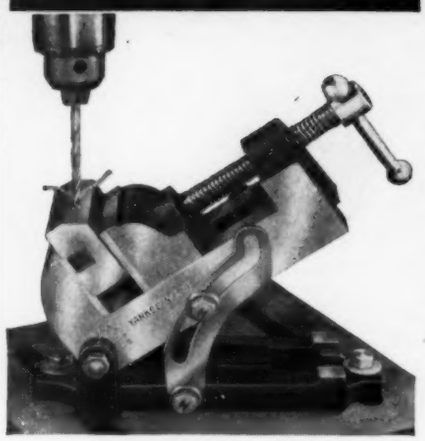
MAIL COUPON FOR DETAILED SPECIFICATIONS

- CLAUSING MANUFACTURING CO.
- 227 Richmond Ave., Ottumwa, Iowa
- Please send complete literature on Clausing Precision Lathes.
- Name .....
- Address .....
- City .....
- State .....

Angle set-ups FASTER!



CHEAPER!



"YANKEE" ANGLE VISES

No need to make a big fuss about small jobs. Just two easy steps with a "Yankee" Angle Vise. (1) Lock the work in the Vise which is machined square and true on base, sides and front end. (2) Tilt for any angle up to 90° and engage positive adjustment lock. You are then set up for any operation . . . hand work on the bench; for drilling, milling, grinding or sawing. Vise lifts off and on swivel base on bench for easy transfer to machine . . . without disturbing work alignment. Shortcuts elaborate set-ups and duplicate calculations, saves mistakes and wasted material. Available in two sizes . . . 2" and 2¾" jaw widths . . . with or without swivel base. Your industrial distributor stocks them.

Write for "Yankee" Tool Book

"YANKEE" TOOLS NOW PART OF

STANLEY

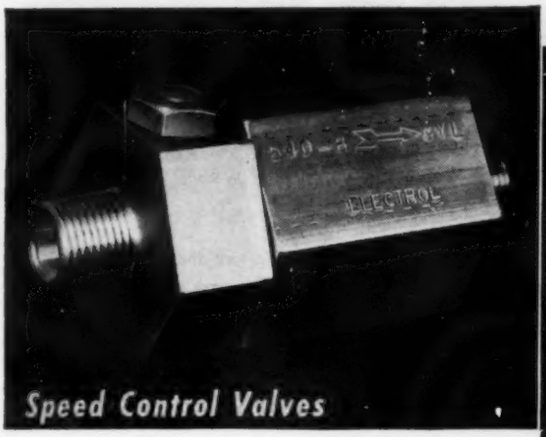
Reg. U. S. Pat. Off.

THE TOOL BOX OF THE WORLD

NORTH BROS. MFG. CO.
Philadelphia 33, Pa.

Electrol Hydraulic Devices
—in Stock or Made to Order—
FOR EVERY INDUSTRIAL NEED

Pictured here are but a few of the many hydraulic devices produced by Electrol for industry . . . transportation . . . and agriculture. We will gladly supply further details as to the application of these units in the machines you use or the products you make. Or—better still—have our engineers work with you in adapting them to any specific design.

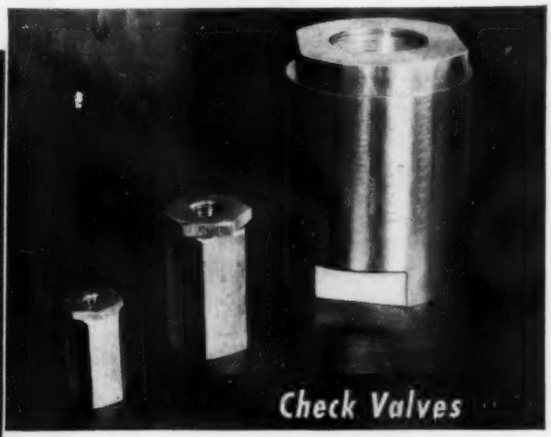


Speed Control Valves

Allow flow in one direction and, by use of a metering device, accurately control reverse flow from 0 to valve max.—even after thousands of cycles. Flow controlled by screw-actuated metering pin. Handle air or oil, with pres sures up to 1,500 p. s. i. Standard sizes: ⅛, ¼, ⅜, ½ and ¾" N. P. T.

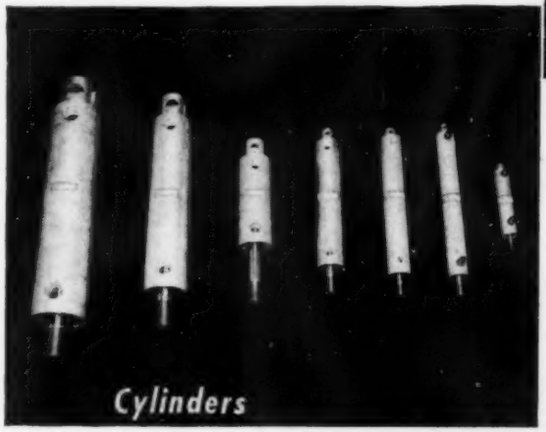
Hand Pumps

Uniform two-way action for maximum operating efficiency. Low in cost, economical in operation. Few moving parts, minimum of maintenance. Operating pressure: 0 to 1,500 p. s. i. Pump delivery: 1.5 cubic inches per cycle. ⅜" N. P. T. ports. Suction and pressure check valves built in.



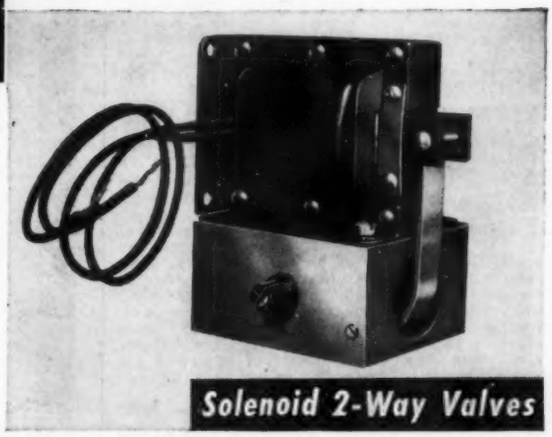
Check Valves

Provide positive sealing from low to high pressures—5,000 p. s. i. max. Used for air, gas, water and oil control with min. pressure drop and positive sealing against return flow. Standard models feature bronze and brass elements. Standard sizes: ⅛ to 2" N. P. T.



Cylinders

"500-1 Series" hydraulic cylinders available in bore diameters ranging from ¾" up to and including 3". Chromium plated piston rods, honed seamless steel tubing cylinders. Conventional "O" ring packings. Clevis mounting and standard pipe ports. Can be used in air or oil. Pressures up to 1,500 p. s. i.



Solenoid 2-Way Valves

Continuous duty, 110-volt, 60-cycle AC Solenoid 2-Way Valves with operating pressures from 0 to 3,000 p. s. i. Port sizes: ⅛, ¼, ⅜ and ½" N. P. T. Supplied either normally open or closed. Balanced type poppet and seat assures positive operation with no internal or external leakage. Other 2-Way Valves available with 12 and 24-volt DC Solenoids.

Electrol
INCORPORATED

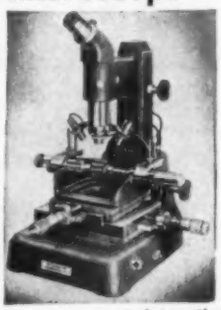
KINGSTON, NEW YORK

CYLINDERS • SELECTOR VALVES • FOLLOW-UP VALVES
CHECK VALVES • RELIEF VALVES • HAND PUMPS
POWERPAKS • LANDING GEAR OLEOS • SOLENOID
VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT-OUT VALVES • SPEED CONTROL VALVES

FOR BETTER HYDRAULIC DEVICES

SCHERR *aids to precision – production*

Low-Priced and Practical Toolmakers Microscope— The WILDER



Here it is at last—a precision checking tool that every shop needs, at a price that any shop can afford. Measures two ways with micrometer to .0005, or with gage blocks for closer accuracy. The image is on a clear glass reticule for maximum definition. Has understage lighting for shadow image, and surface lighting for reflected image. An essential instrument in today's precision demands, at a most interesting price. Write!

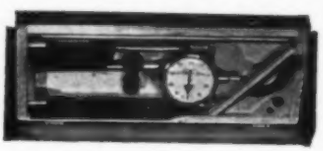
Gears have no secrets from the PARKSON GEAR TESTER Tests gears in mesh

Locates distance, center to center, at which gears run best. Measures backlash, reveals any pitch line eccentricity, thick teeth, spacing errors, off-center teeth, burrs. Registers deviation on dial indicator in .0005". With autograph Recording device (for spurs and helicals only) makes permanent records on waxed discs, which can be kept for reference on gear quality. Capacity, 9" between centers. Other models to 36". For all types of gears. A valuable, trouble-saving tool, widely used wherever gears are made.

Get low-cost precision with ULTRA-CHEX GAGE-BLOCKS

The last word in modern basic accuracy brought within the grasp of all shops large and small. Sets in size for all budgets. All blocks accurate to five millionths. Illustrated is the 34-block set, giving 80,000 combinations in steps of 1/10,000", with optical flat for checking wear. Low prices allow for constant practical shop use in setting tools, checking gages, locating holes in jigs and fixtures, etc. Many shops use a number of sets, with one master set for reference. Set shown, $125.

Get enduring accuray in SCHERR DIAL INDICATORS



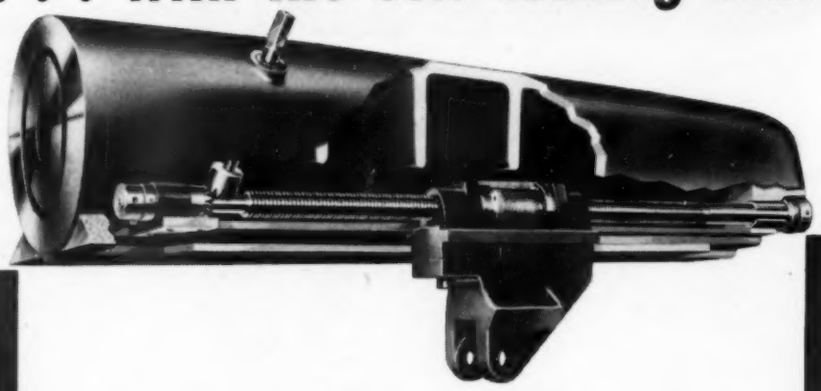
Last longer and cost less. Have an exclusive mechanism of extra sturdiness,, with only three moving parts. No quick spinning wheels or unhardened racks. Furnished with standard back or with ball-joint back for setting at any angle. Contact points for all needs. With clamp holder, extension bar, tool-post holder, in compact metal case. Indicator Only, $10. Complete set with universal attachments, $19.75.

Write for full details on these tools

GEO. SCHERR CO., Inc.
200-D Lafayette St. New York 12, N Y

THE SHAPER

. . . with the self-locking ram!

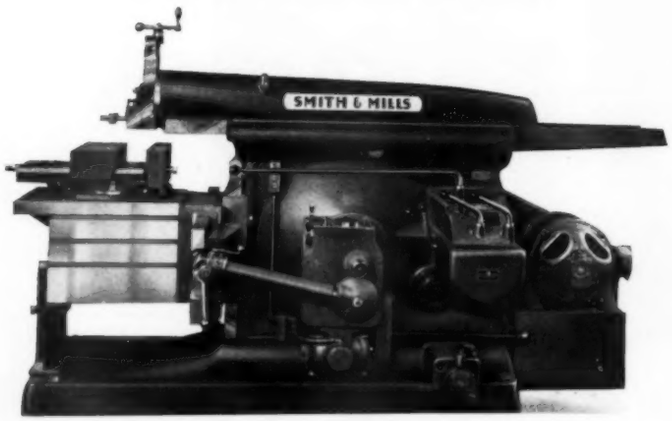


● In Smith & Mills Heavy Duty Crank Shapers the ram locks automatically without hand lock or clamp. To position ram, operator simply turns a convenient shaft while machine is operating or stopped. Automatic compensating double-nut prevents adjustment from changing under even the heaviest cuts. Thrust of cut is taken on large diameter ram adjusting screw mounted between ball thrust bearings.

Elimination of ram slot and locking stud permit far stronger ram . . . cross ribbed to stiffen bearing surfaces, assuring extreme and lasting accuracy.

Wide range of feeds combined with high speeds and simplicity of operation. Operating controls centralized . . . large direct reading dials. Automatic forced feed lubrication . . . Timken tapered roller bearings . . . hardened alloy steel gears and splined shafts.

For complete details write for catalog 62.

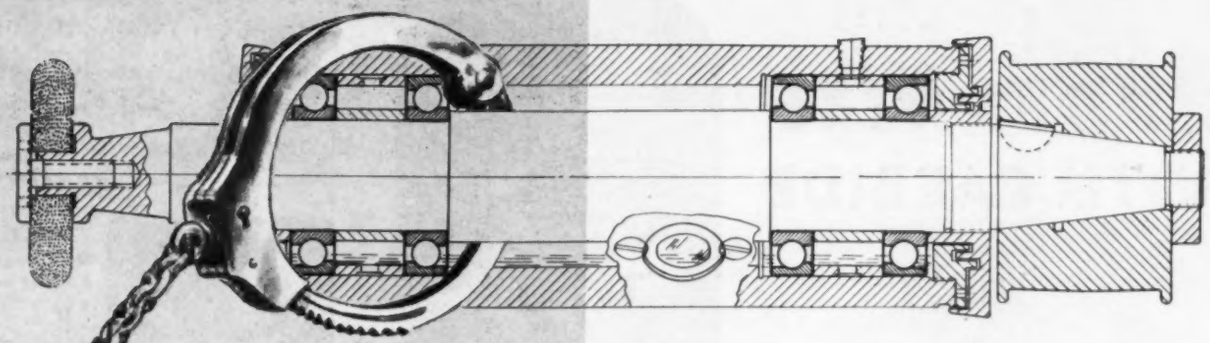


Available in 12", 16", 20", 25", 28" and 32" sizes, each designed and built with ruggedness exceeding capacity.

S&M

The SMITH & MILLS Co.

2889 Spring Grove Ave., Cincinnati 25, Ohio



HANDCUFFS for runaway r.p.m.

Mile-a-minute speeds are no problem on a straightaway. But put that kind of speed on a one-inch grinding wheel and you've got something to hold . . . especially on precision grinding where "dimensional control" won't permit even a ten-thousandth of an inch deviation of the periphery. With spindle speeds going up to keep production costs down, the problem is how to stop deviation where it begins, at the spindle.

One at a time . . . whether one or thousands of ball bearings

What used to be called "precision ball bearings" can't hold a spindle in line at such speeds. It takes a special breed of ball bearings . . . Fafnir Super-Precision Ball Bearings. Whatever the quantity, one or thousands, each of these specialized bearings completes an inflexible processing, individual supervision and inspection with precision gages and fixtures, at every step. Such extreme care pays, in reduced machining time, in better products at lower cost.

Many problems . . . many solutions

You may not need ball bearings as precise as these. That isn't all that Fafnir's offering you. We are offering an attitude and an aptitude . . . a way of looking at ball bearings from where you're sitting . . . an aptitude for doing just what you'd like done about it, gained from solving the bearing problems of not just one or two industries but of all industries. The Fafnir Bearing Company, New Britain, Conn.

MOST COMPLETE LINE IN AMERICA

FAFNIR
BALL BEARINGS

MODERNIZE WITH CARBIDE

ANY OF THESE BLADES* WILL FIT ANY LOVEJOY STANDARD 4½"-24" DIA. TYPE "A" CUTTER EVER BUILT!

More proof of Lovejoy Milling Cutter economy. Even if you have Type "A" mills that are 30 years old, you can utilize them to full advantage with carbide tipped blades with either positive or negative rake. The housings, whether 4½" to 24" in diameter, all take the same blade size. Their rigid construction permits the use of only ½ the regular number of blades, increasing chip load with low H.P. Thus you need no large blade inventory, but can rely on Lovejoy's large stock and prompt delivery with tips of any standard grade. You can, of course, use these same housings for standard H.S.S. or cast alloy blades —here too a single blade size will fit the complete range.

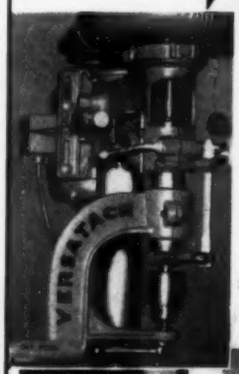
*A single size of H.S.S. and cast alloy blades will also fit every housing size.

"TOOL BITS"

Modern shop technique often calls for milling cutters with negative rake blades. Although certain phases of this technique are standardized, new discoveries on speeds, feeds, rake angles, etc. are being discovered regularly. Lovejoy is in constant touch with these new developments, both through their own experiments and through reports from production plants in all parts of the country. Lovejoy will be pleased to supply any information in its files and all newly acquired data. When inquiring, please give details on machine, material to be cut, etc.

Lovejoy
TOOL COMPANY, INC.
SPRINGFIELD, VERMONT

Now! You Can Cut Internal Keyways on an Ordinary Drill Press Easily and Quickly with the *Versatach*



FITS ANY STANDARD DRILL PRESS

Also Does:
- Power Filing
- Form Filing
- Sawing
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- And many other operations

Saws and Holders are available for $1.75 each

Additional files in 1/8", 3/16", 1/4", 5/16", 3/8", 7/16" and 1/2" sizes. Available at $1.75 each including Holders

Price Complete with One 3/16" File and Holder **$29.75** POSTPAID

If additional files are desired add $1.75 for each file and holder. BE SURE TO FURNISH DIAMETER OF DRILL PRESS SPINDLE QUILL. *FULLY GUARANTEED.*

If Your Local Dealer cannot Furnish the VERSATACH Write Directly to

THE SENEWA COMPANY, Dept. A,
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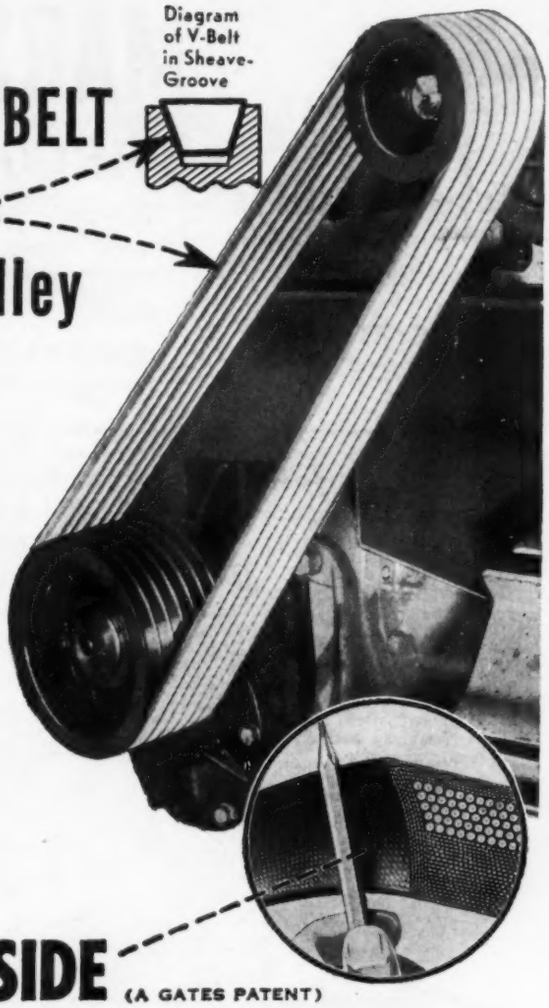
BUY ★ U.S. ★ SECURITY BONDS *NOW!*

The SIDE of a V-BELT is what GRIPS the pulley



Naturally, it GETS the WEAR!

Any one familiar with V-Belt drives knows that the sides of a V-Belt are what really get the wear.

It's the *sides* that grip the pulley. They *pick up* all the power from the driver pulley, *transmit* that power to the belt as a whole and then, once more, they *deliver* the power to the driven pulley. And, clearly, it's the *sides*—and *only* the sides—that take the wear against the sheave-groove wall.

That is why you have always noticed that the *sidewall* of the *ordinary* V-Belt is the part that *wears out first*—and, naturally, if you prolong the life of the sidewall, you *lengthen* the *life* of the *belt!*

Now See How the CONCAVE SIDE (A GATES PATENT) SAVES Sidewall Wear and Lengthens Belt Life!

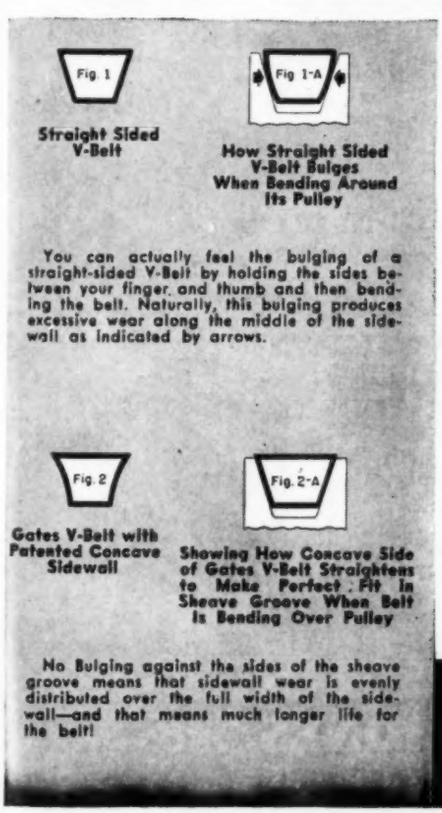


Fig. 1
Straight Sided V-Belt
Fig. 1-A
How Straight Sided V-Belt Bulges When Bending Around Its Pulley
You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.
Fig. 2
Gates V-Belt with Patented Concave Sidewall
Fig. 2-A
Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley
No Bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

The simple diagrams on the left show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. The diagrams show also why the Patented Concave Side greatly *lengthens the life* of the *sidewalls* of Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belt can possibly give.

Saving SIDEWALL WEAR is more important NOW than ever before. ..

Now that Gates *SPECIALIZED* Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY *Denver, U. S. A.*

"The World's Largest Makers of V-Belts"

487

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

★
SAVES TIME
MAKES MONEY
★
CUTS ANY SHAPE
CUTS ANY SIZE
★
CAPACITY UP TO
1/4" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

MARSHALLTOWN MANUFACTURING COMPANY
910 Nevada Street — Marshalltown, Iowa

Automatic Centerless Feed of cylindrical work means low cost FINISHING . . . on the No. 101 "PRODUCTION" POLISHING MACHINE

No centering, chucking or holding of work is required on this fast, high speed polishing machine. Work is fed automatically and any grade of finish can be attained at lowest costs.

Features include ball bearings, belt or motor drive, truing of wheel while in motion, centerless feed and all parts carefully guarded yet readily accessible.

SEE OUR EXHIBIT—
SPACE 1327
NATIONAL METAL
EXPOSITION
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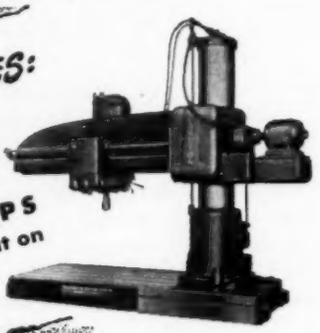
Production
MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

CARLTON SUPPLIES:
RUTHMAN GUSHER COOLANT PUMPS
as standard equipment on their radial drills.



Yes, more and more of the leading machine tool manufacturers all over the country supply Ruthman Gusher Coolant Pumps as standard equipment on their machines. They have learned from experience that Ruthman Pumps give their customers long service, low maintenance costs and efficient operation at all times.

Illustrated above is a Carlton Radial Drill equipped with a Model UL Immersed type Gusher Coolant Pump.

Photo Courtesy The Carlton Machine Tool Company Cincinnati, Ohio

THE RUTHMAN MACHINERY CO
1818 READING ROAD — CINCINNATI 2, OHIO

BUZZER INDUSTRIAL *Gas* EQUIPMENT
*Reg U.S. Pat. Off

No Blower or Power is needed to reach High Temperatures with a "BUZZER" Gas Furnace . . . just connect to your gas supply.

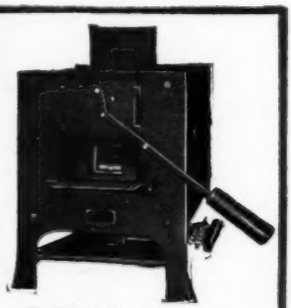
Rectangular Heat Baths

For liquid heat treating baths, soft metal melting, etc.

The High Speed Full Muffle Furnace attains a temperature of 2400° F., and is designed for High Carbon and Alloy Steels.

BUZZER Rectangular Heat Baths meet the increasing demands for large liquid Heat Bath Furnaces, and are built in many sizes. Also made in round type pot furnaces

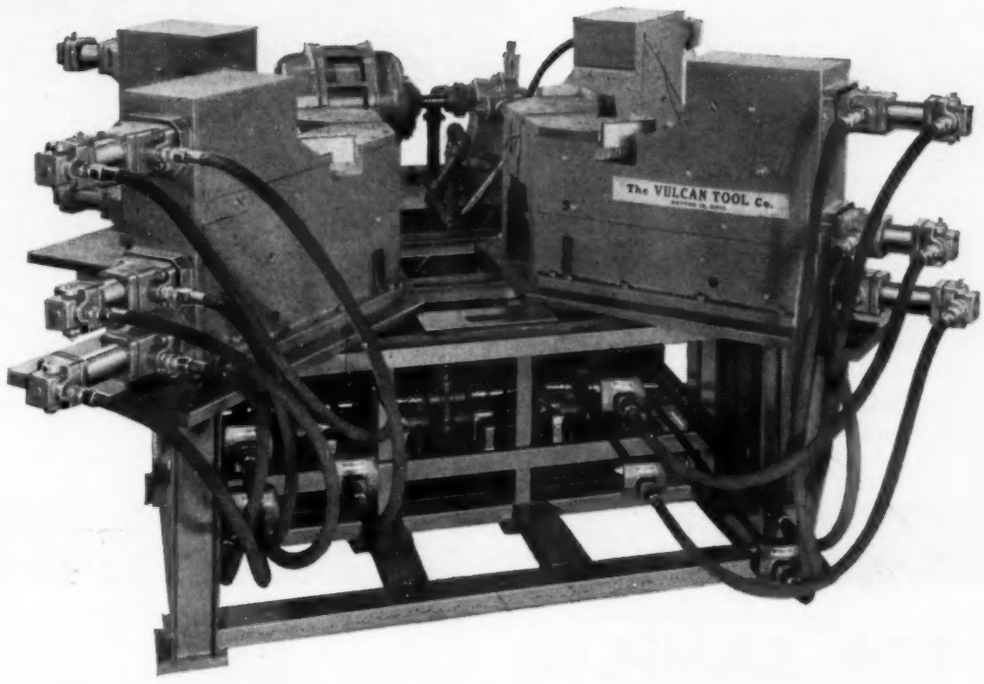
Send for the new BUZZER Catalog showing full line of Gas Furnaces, Burners and other equipment.



Full Muffle Furnace (Bench Type)

CHARLES A. HONES, INC.
121 South Grand Avenue — Baldwin, L. I., N. Y.

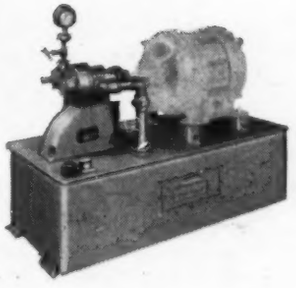
GEROTOR does the job!



...IN THIS HYDRAULIC CORNER-FORMING UNIT

manufactured by the Vulcan Tool Company, Dayton, Ohio

In the production of refrigerator food compartment liners, this Vulcan special machine tool saves money, time and space . . . forms 4 corners every 7 seconds, simultaneously. The unit employs GEROTOR hydraulic devices throughout . . . multiple cylinders and valves (shown above) activated by a complete pump unit (right).



GEROTOR engineers specialize in saving you money, time and space . . . with hydraulic and pneumatic applications that **prove** GEROTOR does the job!

Write for Catalog Section G-105 (Hydraulic Pump Units), 102 (Cylinders), 200 (Valves).

hydraulic pumps, motors, valves & cylinders • air valves & cylinders

GEROTOR MAY CORPORATION • BALTIMORE 3, MD.

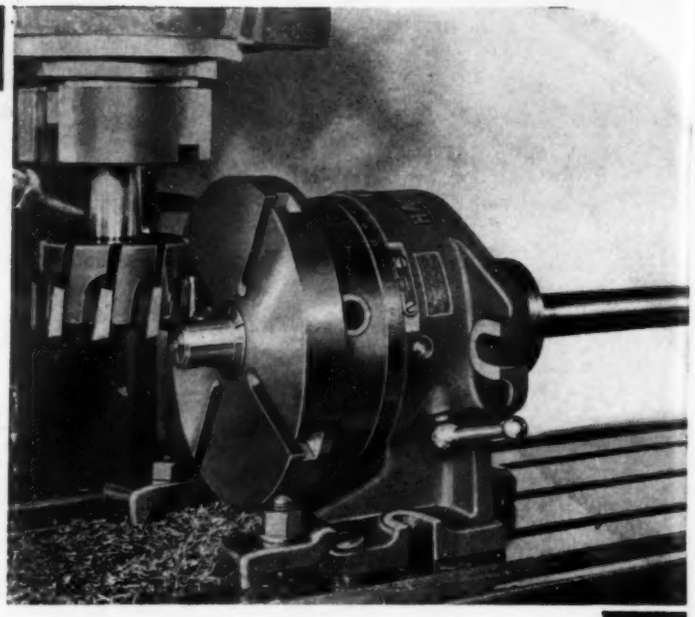
GEROTOR

SUPER-SPACER

FOR

MILLING

The uses of the Super-Spacer in horizontal and vertical milling operations are unlimited. Here the Super-Spacer, mounted with a face plate and draw-in collet combination, shows its adaptability for milling bar stock. Investigate your present milling methods and see if your shop can't profit by the speed and accuracy of the Super-Spacer. For complete details write Dept. S2.



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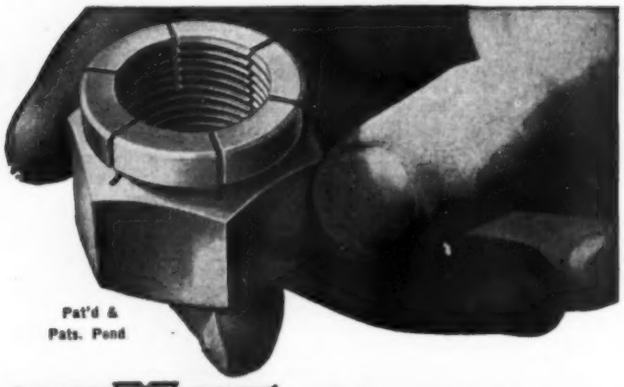

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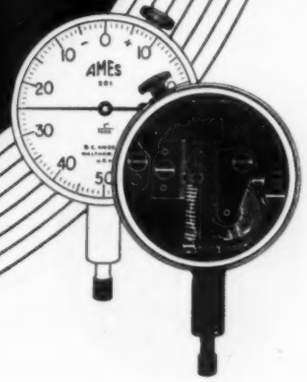

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Cincinnati #3S Univ. Horizontal
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Cincinnati #2M Univ. Horiz.
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Brown & Sharpe #1D Univ. Horiz.
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Garvin #14 Plain Horizontal
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Milwaukee #2B Dble. Overarm, Horiz.
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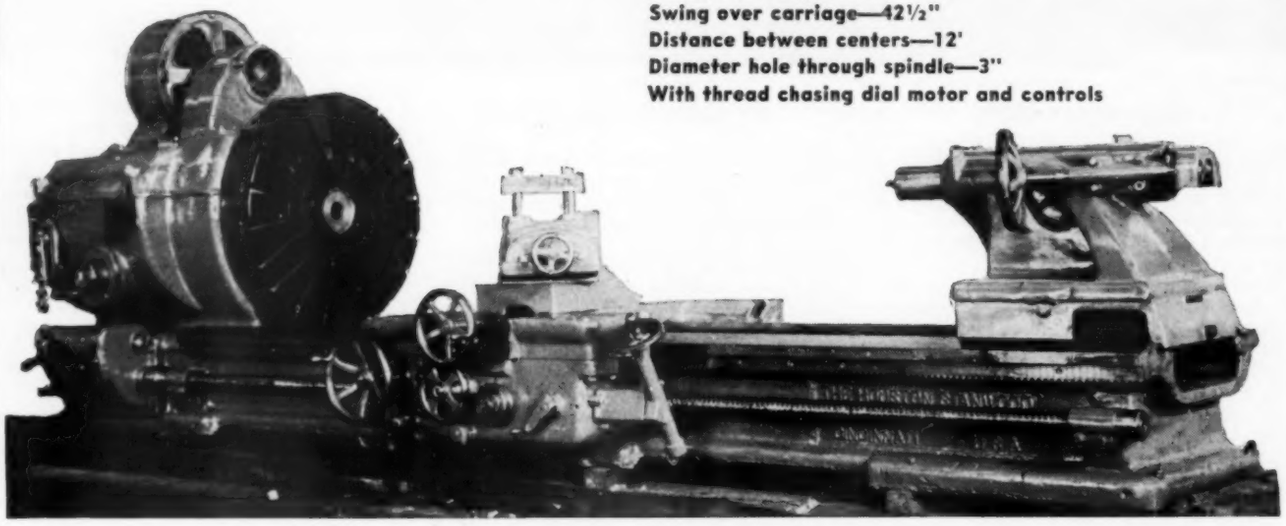
Diameter hole through spindle—3"
With thread chasing dial motor and controls



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Large stock 19" and 18" bench and floor type.

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13"x30" centers Pratt & Whitney Model B Geared Head, m.d., taper
13"x48" Pratt & Whitney, m.d.
14"x30" centers American Pacemaker, m.d., latest
14"x30" centers Lodge & Shipley Selec. Head, m.d., latest
14"x36" centers Springfield, m.d.
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' LeBlond, cone
14"x6' Springfield Geared Head, m.d., taper
14"x8' American Geared Head, m.d.
14"x8' Bradford Geared Head, m.d.
15"x6' LeBlond Geared Head, m.d.
16"x36" centers Pratt & Whitney Geared Head, m.d., taper
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' Lodge & Shipley Selective Head, m.d.
16"x6' Monarch Geared Head, m.d.
16"x10' Hendey Yoke Head, taper
17"x6' LeBlond Geared Head, m.d.
17"x12' LeBlond Geared Head, m.d., taper
18"x5' LeBlond Geared Head, m.d.
18"x52" centers American Geared Head, m.d., taper
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey Geared Head, m.d., taper
18"x8' Lodge & Shipley Selec. Head, m.d.
18"x8' Lodge & Shipley Cone Head
18"x8' Whitcomb-Blaisdell Geared Head, m.d.
18"x10' Lodge & Shipley Selec. Head, m.d.
19"x10' LeBlond Geared Head, m.d.
20"x8' Cisco, cone
20"x10' Sidney Geared Head, m.d.
21"x18' LeBlond, cone
22"x70" centers Greaves-Klusman Geared Head, m.d., taper
22"x8' Lodge & Shipley, cone
23"x12' LeBlond Geared Head, m.d., taper
24"x10' American, cone, taper
24"x10' Greaves-Klusman Geared Head, m.d., taper
24"x10' Lodge & Shipley, cone
24"x10' Hendey Geared Head, m.d.
24"x12' Bridgeford Geared Head, m.d., taper
24"x12' LeBlond, cone
24"x14' Boye & Emmes, cone
24"x24' American, cone
25"x10' LeBlond, cone
30"x12' Lehmann Hydratrol, m.d., latest
30"x12'6" Niles, m.d., taper
36"x12' Lehmann Hydratrol, m.d., taper, latest
36"x21' centers Putnam Geared Head, m.d.
36"x32' centers Putnam Geared Head, m.d.
36"x36'6" bed Niles Heavy Duty, m.d., p.r.t., latest
50"x204" centers LeBlond H.D. Geared Head, m.d., p.r.t., taper, latest

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1A Milwaukee, m.d. in base
No. 1M Cincinnati, m.d.
No. 1½, 2, 3 Cincinnati, cone
No. 2B Brown & Sharpe, m.d. in base, latest
No. 2L Cincinnati, m.d.
No. 2 Cincinnati High Speed Dial, m.d., latest
No. 2HL Milwaukee Plain, m.d. in base, latest
No. 2 Rockford, m.d., vert. attach.
No. 3S Cincinati, m.d.
No. 3, 4 Kempsmith Plain Maxi-Miller, m.d.
No. 3 Van Norman Duplex, s.p.d.
No. 4 Cincinnati Medium Speed Dial Type, m.d. in base, latest
No. 4 Cincinnati H.P., m.d.
No. 4 Ohio, cone
No. 5B Heavy Brown & Sharpe, m.d.
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 Heavy LeBlond, s.p.d.

UNIVERSAL MILLING MACHINES

No. 2 Cincinnati Medium Speed Dial, m.d., latest
No. 2 Cincinnati, cone
No. 3 Cincinnati Medium Speed Dial, m.d., with motor driven overarm, latest
No. 3 Brown & Sharpe, cone
No. 3A Brown & Sharpe, m.d.
No. 3 Kempsmith, cone
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d.
No. 4G LeBlond, s.p.d.

VERTICAL MILLING MACHINES

No. 08 Cincinnati, m.d., latest
No. 2, 3, 4 Cincinnati H.S. Dial Type, m.d., latest
No. 3, 2 Cincinnati Medium Speed Dial Type, m.d., latest
No. 2M Cincinnati, m.d.
No. 2, 3, 4 Cincinnati High Power, m.d.
No. 2H, 4H Milwaukee Dial Type, m.d., latest
No. 2HL Milwaukee Swiveling Head Dial Type, m.d., latest
No. 2K, 3K, 4K Milwaukee Dial Type, m.d., latest
No. 2½B, 3B, 4 Milwaukee, fixed head type, m.d.
No. 3V Van Norman, m.d., latest
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 5 Reed-Prentice, m.d., latest
No. 6 Becker, cone
Cincinnati Hydromatic with 2 vertical spindles on rail, m.d.
No. 3V Toledo, s.p.d.

PLAIN CYLINDRICAL GRINDERS

3x18" No. 5 Brown & Sharpe, m.d., latest
6x18" Landis Type C, m.d., latest, hydraulic
6x18" Landis, m.d.
6x18" Cincinnati Plain Hydraulic, m.d.
6x30" Cincinnati Hydraulic, m.d.
6x32" Fitchburg Type A, m.d. latest
No. 10 Brown & Sharpe, m.d.
No. 11 Brown & Sharpe, m.d.
8x18" Cincinnati Saddle Type, m.d.
8x36" Cincinnati Saddle Type, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x36" Cincinnati Saddle Type Hydraulic, with Filmatic Spindle, m.d.
10x48" Brown & Sharpe, belt
10x72" No. 16 Brown & Sharpe, belt
10x72" Landis, m.d.
12x36" Landis, m.d.
12x48" Cincinnati, with universal type head and spline grinding attachment, Filmatic Spindle
12x48" Cincinnati Self-Contained, m.d.
12x48" Modern, belted m.d.
12x96" Landis, m.d.
14x18" Cincinnati Self-Contained, m.d
14x48" Cincinnati Self-Contained, m.d.
14x52" Norton, motorized
14x72" Cincinnati Self-Contained, m.d.
16x48" Landis Type D, m.d., with hydraulic infeed mechanism, 2 speed hand traversing mechanism
20x120" Landis, m.d., with gap 24" long
26x96" Landis, m.d.

UNIVERSAL CYLINDRICAL GRINDERS

No. 1 Brown & Sharpe Self-Contained, m.d., latest
12x24" Cincinnati Self-Contained, m.d. Filmatic Spindle
No. 2—12x30" Brown & Sharpe, belt
12x30" Landis Hydraulic, m.d.
12x36" Cincinnati Self-Contained, m.d.
12x36" Cincinnati, belt
12x48" Cincinnati m.d., arranged for splines
12x48" Cincinnati Hydraulic, m.d., latest
12x48" Norton Hydraulic, m.d., latest
16x48" Cincinnati, belted m.d.
18x48" Cincinnati Hydraulic, m.d., latest

DISC GRINDERS

No. 4 Gardner, m.d., 16" discs
No. 20 Gardner Comb. Disc and Roll Sander, m.d.
7½ H.P. Standard Double End, m.d., plain & universal tables
7½ H.P. United States Double End, m.d., plain & universal tables

EMERY GRINDERS

½ to 10 H.P. sizes in stock

THREAD MILLING MACHINES

CT-36 Lees-Bradner, m.d.
CT-54 Lees-Bradner, m.d.
Hall Planetary, m.d.
4½x12", 6x14", 6x48", 6x80" Pratt & Whitney, belted m.d.
6x20" Type B Pratt & Whitney Geared Head, m.d. in base
10x24" Hanson-Whitney Thread, m.d.

PLANERS

Type P10 Coulter Crank Type Shaper-Planer, m.d.
20"x20"x5' Whitcomb-Blaisdell, 1 head, belted m.d.
24"x24"x6' Gray, 1 head, belted m.d.
24"x24"x10' Whitcomb-Blaisdell, 2 heads, belted m.d.
30"x30"x10' Gray, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' Gray, 2 heads, belt
36"x36"x10' Cincinnati, 2 rail heads, 1 side head, belted m.d.
36"x36"x10' Niles, 2 heads, belt
36"x36"x16' Cincinnati, 2 rail heads, 2 side heads, reversing m.d., p.r.t.
36"x36"x18' Niles-Bement-Pond, 2 rail heads, reversing m.d.
36"x36"x20' Cincinnati, 2 rail heads, belt
36"x36"x20' Gray, 2 heads, belt
38"x38"x20' Gray Spiral Drive, 2 heads, belt
42"x42"x26' Gray, 2 rail heads, belted m.d.
48"x48"x12' Cincinnati 2 rail heads, reversing, m.d.
48"x48"x12' Gray Openside, 1 rail head, 1 side head, reversing m.d., box table, p.r.t., late type
48"x48"x18' Detrick & Harvey, 2 rail, 2 side heads, reversing m.d.
48"x48"x28' Cincinnati, 2 rail, 2 side heads, reversing m.d.
48"x48"x30' Cincinnati, 2 rail, 2 side heads, belted m.d.
48"x48"x32' Niles-Bement-Pond, 2 rail, 2 side heads, reversing m.d.
48"x48'x40' Sellers, 2 rail heads, reversing m.d.
62"x62"x40' Cincinnati, 2 rail, 2 side heads, reversing m.d.
66"x60"x40' Niles-Bement-Pond, 2 rail, 2 side heads, reversing m.d.
72"x72"x36' Niles, 2 rail, 2 side heads, reversing m.d.
96"x72"x18' Pond, 2 rail, 2 side heads, belted m.d.

PRESSES

No. 3 Loshbough-Jordan O.B.I.
Ferracute D.C. Press, round bed type, 36" between upright, 84 ton cap.
Studebaker 3P 205 Hydraulic Arbor Press, m.d.
Rouselle Model OA Press
No. 20 V & O, Stiff back type
Metalwood Hydro-Pneumatic, type B33 and B45

INTERNAL GRINDERS

No. 16A—16", 16—22", 16RS, 16-38 Bryant Hydraulic, m.d., latest types
No. 24—21", 24—36" Bryant Hydraulic, m.d., latest
No. 6, 10, 20 Bryant, belt
No. 49 Heald Single End Borematic, m.d.
No. 70, 72, 72A4 Heald Plain, m.d.
No. 72A3 Heald Gagematic, m.d.
No. 72A3 Heald Sizematic, m.d.
No. 72A5 Heald, m.d., long bed type, latest
No. 73 Heald Airplane Cylinder, m.d.
No. 74 Heald, m.d.
No. 172 Heald Gap, m.d., cross sliding workhead, new, never set up

SURFACE GRINDERS

No. 10 Blanchard, m.d., 16" chuck
No. 11 Blanchard, m.d., 16" chuck, pract. new
No. 16 Blanchard, m.d., 26" chuck
No. 16 Blanchard, m.d., 30" chuck
No. 22—12" Heald Rotary, 12" chuck, m.d.
No. 25A Heald Rotary, m.d., 16" chuck, pract. new
No. 25A Heald Rotary, m.d., 24" chuck, pract. new
No. 33 Abrasive Vertical, m.d.
No. 260—16" Heald Rotary, belt
10x12x60" Norton Hydraulic, m.d., 60x10" chuck
14" Pratt & Whitney Vertical, cap. 12x36", m.d.
18x60" Thompson Hydraulic, m.d., 60" chuck
18x72" Thompson Type C Hydraulic, m.d., 72x18" chuck
22" Pratt & Whitney Type B Vertical, m.d., 84x15" chuck
24x28"x144" Thompson Hydraulic, m.d., latest type, pract. new
54" Bridgeport Knife, belt

THREAD GRINDER

No. 33 Excello Precision, m.d.

TOOL & CUTTER GRINDERS

No. 2 LeBlond, m.d., latest
No. 3 Gallmeyer & Livingston, m.d.
Cincinnati Monoset, m.d.
Sterling Tool, m.d., latest
No. 2B Sellers Drill, m.d.
No. 4T Sellers Tool, m.d., latest
3" No. 51 Oliver Drill Pointer, m.d.
Gleason Cutter, m.d.
Gould & Eberhardt Gear Cutter, belt
Sellers Bench Type, type 05D, m.d.
Grand Rapids Tap Style No. 12M, m.d.

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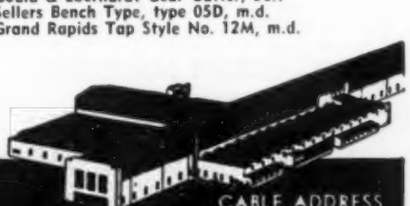

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BRIDGEFORD 36x24' Centers Engine Lathe, Motor Drive

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CINCINNATI 120x96x26' Table Housing Planer, 4 heads, Power Rapid Traverse, Box Table, DC Reversing Motor Drive

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CRANES from 5 to 30 ton capacity all 230 volts, DC current

FRANKLIN 4¼" Bar Horizontal Boring Mill Table Type Motor Drive

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NILES 72x63' Centers, Combination Boring and Turning Lathe, Motor Drive

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Shaper, 16"-20"-24"-36".
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#PG-6 Ferracute punch press, geared 1¾" stroke, slide adjustment.....$3400.00

6" Avey stock cutting band saw, late model, (exceptional machine.....$375.00

Conveyer, app. 100 ft., 8 to 10 ft. lengths.....per ft. $3.50

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Pratt & Whitney upright shaver, excellent condition. Model M-1257.....$550.00

Model RA-6 six-spindle Acme-Gridley automatic, 9/16" cap., Incl. tooling and equipment, ser. #2237A, practically new.....$4550.00

#35P Toledo gap type punch press, 1¾" stroke, Pitman strap and eccentric just rebuilt. Motorized.....$1500.00

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PRATT & WHITNEY 3B Jig Borer Motor Drive, Latest Type

MODEL 4854

BORING MILLS—Horizontal

CINCINNATI-GILBERT 3½" Bar, Floor Type, Latest
DETRICK & HARVEY 4" bar, Floor Type
GIDDINGS & LEWIS #25, 2½" Bar, M.D.
GIDDINGS & LEWIS #32, 3⅛" bar, M.D.
LANDIS #35, 3½" bar, Floor Type
NILES BEMENT POND 5", 6" bar, floor type, M.D.
UNIVERSAL 3" bar, latest type
UNIVERSAL Model 3A, 3" Bar, M.D.

BORING MILLS—Vertical

BETTS 120" 2 swivel heads, AC, M.D.
BULLARD 16" 6 spindle, 8 spindle, Mult-au-matic, Type D Single Indexing, Latest Type
KING 62" 2 swivel Heads, PRT, M.D.
NILES 84" 2 swivel Heads, PRT, M.D.
NILES 100" 2 Swivel Heads, PRT, M.D.

BROACHES

CINCINNATI 1-30 Duplex Vert. Hyd., Latest
CINCINNATI 3-30 Duplex Vert. Hyd., Latest

GEAR CUTTING EQUIPMENT

BARBER COLMAN #3 Hob Sharpener, Latest Type
BROWN & SHARPE No. 3H gear cutter, M.D.
FELLOWS 61, 615A, 7, 7A, 72, 75A, 77, 61A High Speed Gear Shapers, latest type
FELLOWS 12M Involute Measuring Instrument
FELLOWS Type 6Z2 Gear Shaper, High Speed, Latest
FELLOWS #13 LS Lapping Latest Type
GLEASON #20 Spur Gear Tester, Latest Type
GLEASON 8", 12" Straight Bevel Generator, latest
GLEASON #7 Hypoid, Zerol, Spiral Bevel, latest
GLEASON 11", 18" bevel generator, M.D.
GLEASON #17 Hypoid, Zerol, Spiral Bevel Gear Grinder, Latest Type
GOULD & EBERHARDT 36H Hobber with Diff., M.D.
GOULD & EBERHARDT 12HS Hobber, latest
GOULD & EBERHARDT 96H Hobber with DIFF M.D.
PRATT & WHITNEY 10" Grinder, hyd., latest

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3, 4 Universal, Latest
BROWN & SHARPE #5 Plain, 3x12, Latest Type
BROWN & SHARPE #20, 10x18 plain, latest type
CINCINNATI 6x18 plain Model EA, hyd., latest
LANDIS 4x12 Type H Plain Hyd., Latest
LANDIS 10x24 Type C Univ., Hydraulic, Latest
NORTON 10"x36" Type C, Plain, Hyd., Latest

GRINDERS—Internal

BRYANT #5, #16-16 Hydraulic, Latest
BRYANT #16-CP-16, #24 Hyd., Latest
BRYANT No. 24, Hyd., Latest
HEALD #70A Plain, 72A3 Sizematic, Latest
HEALD #72A3 Plain, 72A5 Plain, Hydraulic, Latest
HEALD #72A5 Universal, 74 Hydraulic, Latest
HEALD #81 Sizematic, Hydraulic, Latest

GRINDERS—Surface

BLANCHARD #11—16 chuck, Latest Type
BLANCHARD #16—24" chuck, Motor Drive
BLANCHARD No. 16A—Dial Type—M.D.
DoALL 8"x24" Hydraulic, Latest Type
HEALD #22, 12" chuck, Rotary, latest type
HEALD 25A, 16" or 30" Chuck, Rotary, Hyd. Latest
MATTISON 14x24x72 Hydraulic, Latest Type
MATTISON 14x14x60 Hydraulic, latest type
NORTON 6"x18"—Hyd.—Latest Type
THOMPSON 16x30x48 Hyd., Latest Type

JIG BORERS

MOORE Precision, High Speed, Latest Type
VERNON "Precision" M.D., Latest Type
PRATT & WHITNEY 1A Motor Drive
REED PRENTICE #5 Vertical Die Sinker Latest

LATHES—Engine and Mfg.

AMERICAN 18x72" centers, Geared, M.D.
AMERICAN 56x360" centers 2 Car., M.D.
BRIDGEFORD 36"x32' bed—2 car., M.D.
JONES & LAMSON "Fay" 20x25" automatic TIMKEN, Latest Type
LeBLOND 19"x30" Centers "Regal", Timken, Latest
LeBLOND 17"x5' bed, RP, Timken, latest
LeBLOND 25x96" centers, Geared, M.D.
LEHMAN 16x30 hydratrol, Timken, latest type
LODGE & SHIPLEY 18"x72" centers, M.D.
LOSWING 4x60, 4x84, 8x60, 8x108, 5x34" centers, latest
MONARCH 12x54" centers Timken, Latest Type
MONARCH 22x456" centers, 3 Car., Timken, Latest
MONARCH 10x20" centers, Model EE Timken, latest
MONARCH 16x28" centers, geared hd., M.D.
MONARCH 12x30" centers, Timken, Latest Type
NILES 42"x60", double head, M.D.
NILES 48x87' centers, Comb. Boring & Turning, M.D.
NILES 60x10' centers, Timken PRT, Latest Type
NILES 72"x62', centers, combination Boring and Turning, M.D.
NILES 30x50' Boring, Timken, Latest Type
REED PRENTICE 16x24" centers, geared hd., M.D.
SEBASTIAN 16"x36" Centers, Type H, Timken, Latest
SPRINGFIELD 16"x30" centers, Timken, Latest Type
SPRINGFIELD 16"x42" centers, geared hd., M.D.
SPRINGFIELD 16x24" centers, geared hd., M.D.
WARD HAGGAS & SMITH 18/36"x10' bed, Gap

LATHES—Turret

BARDONS & OLIVER #5, #7 Timken, latest
CINCINNATI ACME No. 1, Latest Type
GISHOLT #3, 4, 5 Univ., Timken, Latest
GISHOLT #1L, #2L, Universal, Timken, Latest Type
JONES & LAMSOON #3, #5, #8A Univ., Latest
LIBBY 1H-5, 5⅛ hole, Timken, Latest
MOREY No. 2G, No. 3, No. 4 Timken, latest
POTTER & JOHNSTON #5D2E, TIMKEN, latest
WARNER & SWASEY #5, Univ. Timken Bearing
WARNER & SWASEY #1A, Univ., Latest Type
WARNER & SWASEY 2A Univ. Bar and Chuck Latest Type

MILLING MACHINES—Mfg.

CINCINNATI 24", 48" duplex, TIMKEN, M.D.
INGERSOLL 42x38x12' Planer type, Adjustable rail, 4 heads, AC, M.D.
INGERSOLL 32x30x12' Planer Type Slab, AC, M.D.
INGERSOLL 32x24x16' Planer Type 2 heads, AC, M.D.
SUNDSTRAND Model 3A Duplex, Latest Type
TAYLOR & FENN M-80 Duplex, Spline, latest type

MILLING MACHINES—Plain

BROWN & SHARPE #2B, Timken, Latest
BROWN & SHARPE 3B, Timken, Latest
BROWN & SHARPE #12 Timken Bearing, latest
CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #3, 4, 5, Motor Drive
CINCINNATI 4-36 Hydromatic, latest type
CINCINNATI 0-8 Auto. rise and fall, Timken, Latest
KEARNEY & TRECKER #3, 4 heavy, Timken, latest
KEARNEY & TRECKER 1218, simplex, latest
KEMPSMITH #4 Maxi-Mill, Timken, latest

MILLING MACHINES—Vertical

CINCINNATI #2, 3, 4, Dial Type, Timken, latest type
GORTON 9J Super Speed, Latest Type
KEARNEY & TRECKER 2H, 2K Timken, Latest
REED PRENTICE #5 die sinker, latest type
REED PRENTICE 3VG with or without Hydraulic Duplicator, Timken Bearing, latest type

PLANERS

BETTS 96x96x20' 4 Heads, PRT, Box Table, M.D.
CINCINNATI 120x96x26' 4 Heads, Box Table, M.D.
CHANDLER 36x36x20', 4 heads, AC, M.D.
CLEVELAND 48x28x6' Openside 3 heads, M.D.
DETRICK & HARVEY 48x48x16', 4 heads, Hyd.
GRAY 36x36x8', 2 heads, maximum duty, DC, M.D.
NILES BEMENT POND 48x48x16', 4 heads, AC, M.D.
NILES 48x48x12' 3 Heads, DC, M.D.
NILES 54x54x18' 4 Heads Box Table, DC, M.D.
NILES 72x72x25' 4 Heads Box Table, DC, M.D.

PRESSES

BIRDSBORO 325 ton, vert,. hyd., Latest Type
CHAMBERSBURG 50 ton vert, hydro-pneumatic
CHAMBERSBURG 200 ton, horiz., straightening, M.D.
CLEARING Type DS-1125-32 dbl. action 125 ton, Latest Type
CLEARING Type H-50-36 35-ton Vert. Hyd., Latest
FERRACUTE #DG-55, 75 ton drawing, Latest Type
GLEASON 15 ton Quenching, M.D.
HPM 37-ton Vertical Hydraulic, Latest
WATSON & STILLMAN 20 ton hyd., sgt., Latest

SCREW MACHINES—Automatic

BROWN & SHARPE #4, 1½" capacity, latest type
GOSS & DeLEEUW 8", 5 spindle Chucker, Latest

MISCELLANEOUS

AJAX 1½", 3½", Bolt Heading, Upsetting and Forging
BARNES #172, 306H, 307 Vertical Hone, Latest Type
CLEVELAND 12"x16" Cutter Reliever, Motor Drive
FOSTER 4"x18" Super Finisher, Latest
JONES & LAMSON 6x15", 8x48" thread grinder, latest
LANDIS "LANDMACO" 1½" Bolt Threader, Latest
MICHIGAN Model 1708 Cutter Reliever, Latest
PRATT & WHITNEY "Keller" Type G, Type BL2416 —Latest Type
PRATT & WHITNEY ½Bx30, ½Bx50 2 spindle Deep Hole Drill, Latest
PRATT & WHITNEY ½Bx50 2 spindle Rifler, Latest
REED Model 21 Thread Roller, Latest

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LATE TYPE MACHINE TOOLS

MOST MACHINES

New — 1941-1945

Motor Driven — Excellent Condition

BORING MILLS

#22 Defiance, 2½", Table Type
#25B Defiance, 3¾", Table Type
#40-4" Landis Floor Type
5" Ohio Floor Type
#48A Heald Single End Borematic
#49 Heald Univ. Single End Borematic
#49 Heald Single End Borematic
24", 36" & 42" Bullard Spiral Drive Vertical Turret Lathes

GEAR MACHINERY

12" Gleason Straight Bevel Gear Generator
#13 Gleason Univ. Gear Tester
15" Gleason Quenching Press
15" Gleason Spiral Bevel Cutter Sharpener

GRINDERS

#72A3 Heald Sizematic Internal
#72A3 Heald Plain Internal
16" x 16" x 48" Thompson Type C Hydraulic Surface
12" x 5" J. & L. Model TG125 Internal Thread
14" x 48" Cincinnati, Plain
#13 Brown & Sharpe Universal & Tool
#1 & #2 Brown & Sharpe Universal

LATHES

25"x120" LeBlond
42"x108" Niles
16"x30" Sidney Monotrol
16"x36" Pratt & Whitney

NUT & BOLT MACHINERY

#250C Manville SSSD Header
#2 Waterbury Farrel Automatic Nut Tapper
#33 Waterbury Farrel DSOD Header
5/16" National SSSD Ball Header
#500C Manville Thread Roller

PLANER

42" x 42" x 18' Gray
54" x 42" x 18' Gray
48"x48"x26' Niles Bement Pond

PLAIN MILLING MACHINES

#000 Brown & Sharpe Automatic
#2-18 Cincinnati Automatic
#1H-18" Kearney & Trecker Mig.
#1854 Kearney & Trecker Simplex
#3-24 Cincinnati Plain Hydromatic
#4-36 Cincinnati Plain Hydromatic
#2SP Van Norman
#3SP Van Norman
#26 Van Norman, Ram Type
#4K Kearney & Trecker
#5H Kearney & Trecker
#5HM Kearney & Trecker

UNIVERSAL MILLER

#3SU Van Norman

VERTICAL MILLERS

#2 Cincinnati Dial Type, Medium Speed
#2K Kearney & Trecker
#4K Kearney & Trecker
#2 Standard Brown & Sharpe

TURRET LATHES

#1A Warner & Swasey Geared Head
#2 Warner & Swasey Geared Head
#4 & #5 Warner & Swasey Geared Head
#3 Gisholt Geared Head
#5U Foster, Geared Head
#7A Jones & Lamson Geared Head
#1L Gisholt Geared Head

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AUTOMATICS

8" & 16" Bullard Multaumatic
1⅞" Conomatic 8 spindle
8"x15", 14"x19" & 16"x33" Fay
Gisholt Simplimatic
1¼" Cleveland 4 spindle

BROACHES

No. 1 Foote Burt vert. surface
Twin Ten Oilgear double
No. 3XA Oilgear
30 ton No. V48 American vertical
No. 3 Lapointe screw type

DRILLS

21" & 24" Cincinnati upright
Nos. 121, 217, 314 & 315 Baker heavy
6', 15" Cint. Bickford radial
24", 6 spindle Foote Burt sensitive
3', 10' Morris Radial
4' Hammond Elbow Arm Radials
B4A—24 spindle Natco
24", 4 spindle Allen & Demco
12", 4 spindle Avey No. ½
15", 3 spindle Avey Type MA6

GEAR MACHINERY

No. 50 Cross Tooth Thinner
8H, 12H & 16HS Gould & Eberhardt
No. 12 Barber Coleman
No. 5M Adams Hobber
No. 4 Cimatool Rounders
No. 130 Cleveland Rigidhobber
No. 12 Gleason Two Tool Rougher

GRINDERS, CYLINDRICAL

4"x12" No. 4H Landis
6"x18" Norton, Landis, & Brown & Sharpe
Nos. 1, 2, & 13 Brown & Sharpe Universal
10"x18", 10"x30", & 10"x50" Norton mechanical
10"x18" Landis Type C, Hyd.
10"x24" & 16"x72" Landis Mechanical
14"x36" Landis Type C, Hyd.
16"x36" Landis Type D, Semi-Auto. Hyd.

GRINDERS, SURFACE

16" No. 10 Blanchard Rotary
30" No. 16 Blanchard Rotary
12" & 16" No. 22 Heald Rotary
16" & 24" No. 25A Heald Rotary
8" Pratt & Whitney Rotary
10"x24" Norton Hydraulic
12"x48" Thompson Hydraulic
14"x60" Mattison Hydraulic
14"x36" Pratt & Whitney Vertical
8"x22" Abrasive No. 3
8"x24" Abrasive No. 34 Vertical
24"x48" Springfield Planer Type
6"x18" #2 Brown & Sharpe

GRINDERS MISCELLANEOUS

20" No. 208 Besley Disc
26" No. 226 Gardner Disc
#115 Gardner 15" Opposed Disc
#230 Hanchett 30" Opposed Disc
72A3, 72A5 Heald Internal Plain & Sizematic
16" & 24" Bryant Internal
#2 Norton Univ. Tool & Cutter
Model HRS Barber Coleman Hob & Cutter
#33 & 35 Excello Thread

LATHES ENGINE

14"x6' Lodge & Shipley
14"x8' American
15"x6' Porter McLeod
16"x30" centers Monarch
18"x8' Lodge & Shipley
36"x16' Bridgeford

LATHES TURRET

24" & 42" Bullard
Nos. 4, 1L & 3AL Gisholt
Nos. 3, 5, 1A, & 3A Warner & Swasey
No. 3 Jones & Lamson
No. 2F Foster Fastermatic

MILLING MACHINES

Nos. 2H, 3H, & 4H Kearney & Trecker Vertical
Nos. 2, 3, & 4 Cincinnati Vertical
Nos. 1, & 1M Kent Owens Hand
Nos. 1-12, 2-18, & 2-24 Cincinnati Automatic
Nos. 2-18 & 2-24 Cincinnati Rise & Fall Automatic
Nos. 3-24, 4-36, 4-48, 5-48, 34-36, 56-72, & 56-90 Cincinnati-Hydromatic
Nos. M-18, M-24, & 12-24 Kearney & Trecker

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Indianapolis QUALITY MACHINE TOOLS

PARTIAL LIST OF MACHINES NOW IN STOCK

28" x 34' "TIMESAVER" ENGINE LATHE, actual swing 29", distance between centers 23'; with Timken Bearing Spindle, L3 spindle nose, hardened spur gears, eighteen speeds; with power rapid traverse and geared taper turning attachment on each carriage, 4 jaw chuck, plain or rotating steady rest, motor and control. Manufactured in 1942 by John Bertram & Sons from Niles patterns and specifications. Several lathes available.

AUTOMATICS

2G Brown & Sharpe, H.S. 1½" capacity. New, 1943.
9/16" RA-6 Acme-Gridley. New, 1943.
1⅝" 6 Spindle Greenlee. New in 1942.
6" 4 Spindle Conomatic. New, 1942.
★**Bullard Multaumatic, six spindle model D, single indirect. Late Model.**

BORING MILLS

★**Universal No. 40 Tri-Way, 4" bar, with facing head rotary table, boring bar, motor and control. New in 1943.**
No. 42 Lucas, 4" diameter spindle, with rectangular revolving table, star facing head, motor and control.
Heald No. 49 "Bore-Matic," three spindles each end. New in 1942.
Heald No. 47A "Bore-Matic."
Heald No. 46B "Bore-Matic."
Excello Model 1212A, Double end. New in 1942.

BROACHES

No. CPC 6-30 LaPointe Hydraulic Vertical. New, 1941.

DRILLS

3' and 4' Dreses Radial, 11" column, enclosed head, 1938 model.
No. H3 Barnes Hydram, 8 speed. New, 1942.
KH 2 Allen. 6 spindle. New, 1943.
Demco 3 spindle drill.
Hamilton-Muehlmat Drill.
No. 3 Baush Multiple Spindle.
Barnes Horizontal Deep Hole, two spindle.
42" Cincinnati-Bickford, single spindle.
25' Fosdick Economax Upright Drill. Late Model.

GEAR CUTTERS

★**No. 12B Gleason Straight Bevel Gear Rougher, complete with gears, tools, setting gauge, motor and control. Like new.**
No. 7A & 715 Fellows Gear Shaper.
No. 615A and 645A3 Fellows Gear Shaper.
No. 12 Barber Colman Hobber.
Model S Barber Colman Hobber.

GRINDERS

No. TG615 Jones & Lamson Thread Grinder. New, 1943.
No. 2 and No. 3 Cincinnati Centerless, Filmatic. New in 1942.
★**No. 2 Cincinnati Universal Tool & Cutter Grinder, complete. New in 1942.**
No. 22 Covel Universal Tool & Cutter Grinder. New in 1943.
No. 3 Brown & Sharpe Universal. New, 1943.
4" x 18" Landis, Type H.
6" x 18" Cincinnati, Filmatic Bearing.
6" x 18" Norton Type C. New in 1942.
★**10" x 48" Cincinnati Plain Hydraulic Grinder reciprocating spindle, hydraulic in-feed. New in 1943.**
No. 22 Heald Rotary Surface Grinder. New, 1943.
No. 18 Blanchard, 30" chuck. New, 1942.
16" x 16" x 48" Thompson Model C, Surface.
3B Abrasive, with chuck. New, 1943.
No. 5 Brown & Sharpe Surface. New, 1942.
No. 15 & No. 18 Gallmeyer Livingstone Surface.
6" x 12" x 18" Thompson Surface Grinder. New, 1942.
No. 2B Reid Surface, for wet grinding.
No. 16CP16 Bryant Hydraulic Internal Grinder. New, 1942.
No. 104 Rivett Internal.
No. 75A Heald Internal. New, 1943.
No. 72A3 & 72A5 Heald Internal. New in 1943.
No. 74 Heald Extended Bridge Type Internal Grinder.

LATHES, ENGINE

Hendey 12" x 30", g.h.
Reed Prentice, 14" x 30" g.h.
Lodge & Shipley Tool Room, 14" x 54", rel. att. New, 1943.
Reed Prentice 14" x 78" Toolroom. New, 1943.
American Pacemaker, 16" x 30". New, 1942.
Reed Prentice 16" x 54". New, 1943.
Sidney 18" x 54". New, 1943.
Lodge & Shipley 20" x 48". New, 1943.
Lodge & Shipley 48" x 54", C.D.
Carroll Jamieson 18" x 5', C.D.
South Bend 14½" x 6'. New, 1944.
Lo-Swing, models IMP and R.

JIG BORER

★ **No. 30 Fosdick, with 16" power rotary table, rods and indicators.**

LATHES, TURRET

Warner & Swasey No. 5 Universal. New in 1941.
Warner & Swasey No. 4 Universal. New in 1941.
Warner & Swasey No. 4A, with chuck, 7½" hole.
★ **Warner & Swasey No. 2A. New in 1943.**
Warner & Swasey No. 1A. preselector, cross sliding turret. New in 1942.
Jones & Lamson No. 9A. New, 1943.
Gisholt No. 3L. Late Model.
Acme No. 1 Universal, saddle type. New in 1941.
Bardons & Oliver No. 7 Ram Type, Bar feed and tooling. New in 1942.
Gisholt No. 4 Universal, Hydraulic speed selector.
Warner & Swasey No. 3 Universal. New, 1942.
Bardons & Oliver No. 3 Universal, motor in base. New, 1941.
Warner & Swasey No. 2. New in 1942.
Bardons & Oliver No. 2, bar feed. New, 1941.
★ **Bullard 36" Universal High Speed Spiral Drive VTL. New in 1942.**

MILLS

Milwaukee No. 2D Rotary Head. New in 1945.
Milwaukee No. 2H Universal. New in 1942.
Cincinnati No. 2M Universal.
Brown & Sharpe No. 2A Universal. Late Type.
Brown & Sharpe No. 1 Universal with vertical milling attachment. Latest model.
Kempsmith Maximiller Plain, No. 3.
Brown & Sharpe No. 3B Plain. New, 1943.
Brown & Sharpe No. 2B Plain.
★ **Cincinnati Vertical Hydrotel, 28" x 60", equipped with 360° profile attachment, and depth attachment. New in 1941.**
Milwaukee No. 3H Vertical. Latest model.
Cincinnati No. 2 Vertical. New, 1940.
Index No. 40H Vertical.
Cincinnati Plain No. 08 and 2-18. Rise and Fall.
Cincinnati No. 1-12 Automatic.
Cincinnati No. 3-36 Hydromatic.
Cincinnati No. 34-36 Hydromatic High column with Hydrotel.
Milwaukee No. 1248 Simplex.
DeVlieg Supermill No. 31B.
Brown & Sharpe No. 12. New, 1942.
Whitney Hand Mill, No. 6.
VanNorman Hand Miller. New in 1942.

MISCELLANEOUS

Grey Nibbler, 36" throat, ¼" capacity.
Savage Nibbler, 8" throat, 3/16" capacity.
Cleveland Rigidturner, No. 616.
14" x 20" Racine Hydraulic Saw.
13" x 13" Peerless High Speed Saw.
Marvel Hack Saw 6" x 6". No. 4B.
No. 4B Do All 16" Band Saw.
No. 26F Norton Hydrolap.
No. 8-6 Zeh & Hahneman S. S. Geared Press.
Toledo No. 41 Horn Press.
Williams White No. 14½ Punch, 1" through 1".
Tapper, Leland Gifford 3' Radial, No. 3 M.T. New, 1941.
Parker Tube Bender, No. 824G.

PLANERS AND SHAPERS

Ohio Planer, 36" x 36" x 16', M. D.
Cincinnati Planer, 42" x 42" x 20', Four heads D.C.
Cincinnati Planer 52" x 36" x 40' four heads, box table. D.C. motor drive.
6" Ammco Bench Shaper.
Gould & Eberhardt 16" Shaper.
Smith & Mills 28" Shaper.
Cochrane & Bly No. 14 Vertical Shaper. New, 1942.
Pratt & Whitney 6" vertical shaper. New, 1943.

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VERTICAL MILLERS

1—Milwaukee #4H Vertical—late type, Motor-in-Base—Table working surface 74"x15½", long feed 42", cross 14", vertical 16".

2—Cin. #1M and 2M Motor-in-Base Vertical Millers—table working surface 37½"x10½".

1—Brown & Sharpe #2 "Light Type" Vertical Miller, late type.

1—Milwaukee #2KM Motor-in-Base Vertical Miller, very late type table working surface 56"x12", long. feed 28", cross 12", vertical 15".

PRODUCTION MILLERS

1—Cin. #2-24 Production Miller with Rise & Fall Spindle Carrier, very late type.

1—Cin. #4-36 Hydromatic Plain Production Miller complete with Braces, latest type.

2—Brown & Sharpe #12 Production Millers 18" tbl. travers elec. controlled.

2—Cincinnati #0-8 Horizontal Millers, (late type).

UNIVERSAL MILLERS

1—Van Norman #2SU Univ. Miller (very latest type), table working surface 50"x12", range long 28", cross 10", vert. 17".

1—Cin. #2 High-Power Rect. Overarm Univ. Miller, MD, table working surface 52"x12", range long 32", cross 11", vert. 20".

TURRET LATHES

1—W. & S. #5 Univ. Turret Lathe, Pre-Selector Head, MD, very late type, Bar & Chucking.

1—W. & S. #3 Univ. Turret Lathe, MD, late type, Bar Equipment.

1—Foster #5 Univ. Ram Type Turret Lathe, MD, very latest type.

1—Bardons & Oliver #3 Univ. Turret Lathe, MD, late type.

1—Gisholt #3L Turret Lathe, very late type, Bar & Grinding.

GRINDERS

1—Blanchard #11 High Power Rotary Surface Grinder, very late type, chuck dia. 16".

1—Brown & Sharpe #2, 14"x30" Universal Grinder (latest type—excellent condition), considerable equipment.

1—Brown & Sharpe #13, 8"x24" Univ. and Cutter Grinder (very clean machine—late type).

1—Pratt & Whitney 14"x60" Hydraulic Vertical Surface Grinder (late type), 14"x60" Magnetic Chuck.

1—Mattison 16"x18"x60" Hydraulic Surface Grinder (very late type), complete with magnetic chuck.

HAMMERS

1—Billings & Spencer 1000# Board Drop Hammer.

2—Chambersburg 2500# and one (1) 4000# Board Drop Hammers.

1—United 3000# Board Drop Hammer.

1—Standard 800# Automatic Hammer, Poppet Type.

BORING MILLS

2—Bullard 36", "Spiral Drive" Vertical Boring Mills (late type).

PRESSES

1—Farquhar 100 Ton Hydraulic Press (equal to new).

1—Billings & Spencer #2 Trimming Press.

1—Henry & Wright 60 Ton Dicing Press complete with double roll feed and scrap cutter.

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LATE MODEL TOOLS

16" & 20" MONARCH Model "C" & "M" Lathes

16"x78" AMERICAN "Pacemaker" Lathe

50"x17' cc LeBLOND "Big Swing" Lathe

10"x72" NORTON Type "C" Plain Cyl. Grinder

12"x48" CINCINNATI Model "ER" Univ. Grinder

14"x16"x60" THOMPSON Type "C" Hyd. Surface Grinder

Nos. 3, 4 & 5 W & S Univ. Turret Lathes

Nos. 3 & 5 J&L Univ. Turret Lathes

3'11" AMERICAN "Hole Wizard" Radial

WIGGLESWORTH MACHINERY COMPANY

203 BENT ST. CAMBRIDGE, MASS.

Kirkland 7-5242

BENNETT SPECIALS

36" Bullard Spiral Dr., 3 Jaw, 1942

6" bar Ingersoll Floor Type Mill 6' vert. & 6' hor., new 1943

5" bar Sellers Table Type Mill, 48" spin. to table, 100" spin. to outer support, '42.

4" bar Universal Table Type Mill, 60" spin. to table, 96" spin. to outer support, '42

3½" & 4" Landis Floor Type Mil's

10"x48" Cinci. Plain, Late

48" x 19'6" centers Niles Heavy Lathe, Taper, new 1943

42"x96" centers Amer., M.D.

36"x32' bed Niles Lathe, 2 carr., T.A.

20"x92" centers Hendey Lathe, T.A., collets

7' Carlton 17" col. Radial, 1943

Nos. 5, 4, 3 & 2 W. & S. Turrets, Late

#4 Gisholt Univ. Turret Lathe, 1942

No. 3K K. & T. Vert. Miller, 1942

48"x48"x24' Gray Planer, 4 Hds., Non-Metallic ways, '42. Var. Voltage

36"x36"x12' Cinci. Hypro Planer, 4 Hds., Var. Voltage, 1943

24"x24"x16' Ingersoll Planer Type Miller, 4 hds., 20 H.P. AC, M.D.

48" N.B.P. Slotter, Grd., Late

15'x¾" Wicks, Bending Rolls, M.D.

16"/19½"x54" cc Springfield Lathe, 1944

BENNETT MACHINERY CO.

30 Church St., New York 7, N. Y.

National Bent Shank Nut Tappers Battery of ⅝" to 1" Machines.

Waterbury-Farrel Fdry. ⅝" and 1" D.S. S.D. Cold Headers, also Thread Rollers.

Fisher 5" Bar, Floor Type Boring Mill. New in 1942.

Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.

Bliss Presses in all sizes up to 1,000 ton capacity.

Wire Working Machinery.

National Machinery Exchange

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GRAY PLANERS, (2) 74"x48"x20', 4 heads, DC Motors

SLAB MILL, 24" ROLLER TYPE, 75 HP MOTOR DRIVE, "IXL" Gear Box

EX-CELLO, Model 33, External Precision Thread Grinders, 6"x18"

LEES BRADNER MODEL CT, THREAD MILLERS, 36" centers, 13" spindle

BRIGEFORD, 14" Axle Turning Lathe

LE BLOND #3 Plain Milling Machine

BROWN & SHARPE, #13-B Manufacturing Mill

FARNHAM, 12' Forming Roll

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MAIN 4462

EQUAL TO NEW

B4B NATCO 48-spdl. HOLESTEEL DRILL, #2 MT

3K K&T High Speed Vertical Miller

#372—53" BESLY Disc Grinder

#1 Brown & Sharpe Wire Feed Hand Screw Machine

ALL LATEST TYPE

HAZARD BROWNELL

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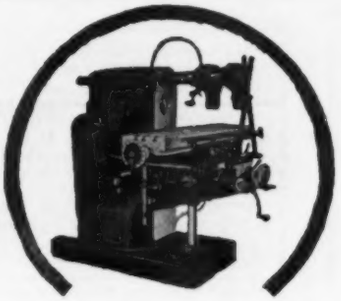
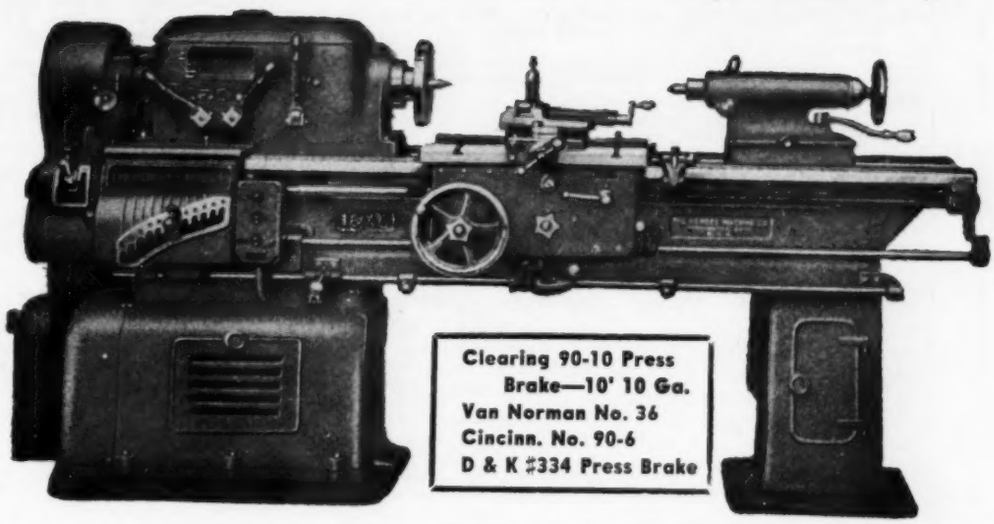


SCARCE LATE MACHINES

Niagara 6'x3/16" Shear; K 10½
B & S 00G Automatics (3)
Van Norman #12, Slotter, etc.
Canedy-Otto 3'9" Col.
Conomatics 6 spdl. 2⅝", 1⅛" late, fully equipped.
NBP 2500 lb. Single Frame Steam Hammer
Ferracute D.D.G. 56, 105 ton Double Action Cam Press.
Universal 3" boring mill
Gorton Duplicators and Vert. Millers, 8D, 9J
Gorton No. 3Z, Engravers
Marvel 6 Hacksaw, M.D., Auto.
Injection Moulders, Hydraulic Presses
Thompson 6 x 18" Hyd. Surf. Grinder
Abrasive 6x18, 8x24 Surface Grinders No. 3B, 34, 1½
Conomatic 1⅞" 8 spindle
Brown & Sharpe #5 Cyl. Grinder
Tannewitz Band Saw #36M
Thompson Seam Welder
Mod. 20 Rafter, New 1945
W & S Nos. 3, 4, 5 Grd. Hd., Preselector
Gisholt No. 5, Univ. Turrets
Acme #6W M.D., Foster 3B
Oliver 20" Woodworking Planer
Oster 601 Rapiduction, Tooling
Hardinge ESM, 2nd operation
Cincinnati 12x36" Univ. Grinder
No. 18, 25 and 35 Gallmeyer and Livingston Hyd. Surface Grinders, 6x18, 8x24
#25A Heald, M.D., like new Rotary Surf.
Cinn. #2 Centerless Grinders Filmatic
B & S No. 2, 2B Surface, M.D.
Norton 6x18" Hyd. Surface, M.D.
Covel #91A Tool, & Cutter
Hammond & Excello Carbide Grind
Gardner #226 Disc Grinder
Monarch EE 10"x20" Lathe
Hendey 12x30, G. H. Lathes
Morey No. 3 Univ. Turret Lathe
South Bend, M.D. 9x3½", 10x48", 13"x5'
Sebastian 12"x4' grd. hd.
Rivett No. 818 bench M.D.
Hardinge Cabinet Lathe
Lodge & Shipley 16"x78" 12 speed Grd. Hd. lathe
Buffalo #0 Angle Roll, Excelsior
Bliss #58.0B Gap Presses ea. 62A, 162
Burke Miller Pl. & Univ.
Nichols Hand Miller, Vert. Hd.
Delta Single & Multiple Drills
Oliver Heavy die Filer, 510
Drill Pointer, Sellers 4G
Taylor Winfield 50 KVA Spot Welder
Peerless No. 226, Eyeletting
Hi Speed Hammers, all sizes
Cinn. #3 Pl., #4 Vert. Dial Type, Rect. Arm, Mills
B. & S. #12 Elec. Prod. #21,000
Waterbury-Farrell #30 Thread Roller & Dies, 1943
Cinn. Bickford 24" Super Serv.
V & O 162 Reducing Press
V & O, 2 & H 25, 35, 75 Ton OBI
Cinn. 1-12, 2-18 Production Mills
Stokes Tablet Presses
Ball & Jewel Plastic Grinders
20"x30' Boye & Emmes Grd. Hd., Lathe
Onsrud Router W240
Mieromatic Hydrohoner HI
Walker-Turner Bench Drills, ½
Porter-Cable G8 Belt Sander
Le Blond 19"x126" ee. Lathe
Wilder Optical Comparator
Black Diamond Drill Grinder
Cinn. & Schauer Speed Lathes
Cleveland #1 Vertical Miller
Rockwell, Clark Hardness Testers
Bakewell #1, Ultromat Tappers



Clearing 90-10 Press Brake—10' 10 Ga.
Van Norman No. 36
Cincinn. No. 90-6
D & K #334 Press Brake

NEW IN STOCK

Power Foot & Gap Shears—30" to 96"
Spot & Arc Welders, 6x6" Racine Hacksaw
5, 7, 14, 18 & 30 ton OBI Power Presses
Ammco 7", Shape Rite 8", Shapers
H.S. Vertical Milling Heads
Drill Presses, Foot Presses
Kalamazoo Metal Band Saws
No. 1½ Abrasive Wet Surface Grinder
20 ton Northern Hydraulic Presses
0Z & 20Z Injection Moulders
Famco 6C Arbor Presses—½ Price

TURRET LATHES

Foster Nos. 4, 5, 6, 1B, 3B, M.D. Univ.
J. & L. 2"x24", 3"x36"

GRINDERS

Surface Grinders, 6x18, 8x24, Abrasive, G. & L.
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D. Cyl.
Heald No. 72A3 Gagematic
Norton 50"x28' M.D. Roll Grinder
Landis Type A 6x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.: 1, 3 Univ.

LATHES

26x12' Boye & Emmes 3 step cone D.B.G.
14"x6' Hendey Taper, Collets 16"x8'
9" LeBlond P&W 1"x18" Automatic
36x30' Putnam M.D., 36x22', 42x16
32"x35' Wickes, M.D.
Wade, Hjorth, Hardinge, P & W Precision Bench

AUTOMATICS

Cleveland Model A ¾", 1¼", 2"; B 1", 2", ⅞"
Cone 4 spindle, Gridley
Brown & Sharpe #4, 6 Auto., #2 Hand Screw

MISCELLANEOUS

Pexto 3' to 8' Shears & Brakes
Gorton 1A; 375-2 Tool & Cutter Grinders
Wiedman Turret Punch—Type R4P
6" Vertical Shaper, P & W
10x10 Peerless Universal Shaping Saw
#7, 72 Fellows Gear Shapers
Deckel G1, G2, G1F Engraving machine
Hanson Whitney Thread Miller, Planetary
Leland-Gifford 1, 2 & 4 spindles, Model MS
Geo Ohl 8' 16 Gage M.D. Shear

HYDRAULIC EQUIPMENT

2000 TON BIRDSBORO PRESS

Self Contained

60" between rods left to right, 53" front to rear. Overall length of platen left to right 144". Stroke 30". Opening 36". 60 H.P., 3 phase 60 cycle, 220-440 V motor.

500 TON LAKE ERIE PRESS

Platen 35"x36", 36" stroke, 68" opening. 150 H.P., 220-440 V. Motor.

350 TON VERSON PRESS

40x40 platen, 36" stroke, 72" opening. 100 H.P. 3 phase—60 cycle 440 volt.

400 & 500 TON SHAFT STRAIGHTENERS, Self Contained

All Hydraulic equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your hydraulic problems.

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3B K. & T. Dbl. Overarm
Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K. & T. Univ.; No. 2, 2A B & S Univ.
No. 3S Cincinnati, S.P.D. rapid trav.
Nos. 1½, 2, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert.
P. & W. No. 12, Morey Profilers
B. & S. No. 1, 3 Vert.
Taylor-Fenn Spline Miller

RADIALS

Carlton 8' Arm 19" col. M.D.
4', 5', 6' American Triple Purpose
Walker-Turner ½" cap.

BORING MILLS

#0 Giddings & Lewis arr. M.D. 3"
2½" Cleveland arr. M.D., 2½", 4" Binsee
Niles-Bement-Pond 4- duplex, 66" Niles
Bullard New Era 24", 42", King 42"

AAron Machinery Co., Inc.

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ROLLS—BENDING—20′ x 1″ cap.—1938
Drop End—Pinch Type for full circles
75 H.P. & 35 H.P. Wt. 74 Ton

IRONWORKER—Pels No. 26 Universal
Punch 1⅜″ thru 1″. Shear 6 x 6 x ¾″ Angles.
15 H.P. All steel. Wt. 10½ Ton

SQ. SHEARS—10′ x 3/16″ cap. With 15″ Gap
15 H.P. Wt. 20 Ton
L. & N. 10′ x 10 Gauge cap.

PLANER—Niles Bement Pond. Working Bed 48″ x 48″ x 26′ with 4 Heads. 15 H.P. D.C. 230 volt. Variable Speeds.
Special Price—$7500.00

RADIAL DRILL—Cincinnati Bickford
7′ x 15″ Round Column. D.C. Drive.
Special Price—$2750.00

AUTOMATIC THREAD GRINDER—J. & L. 1943—Model TG-1245
—Cap. 12″ x 45″. 5 Motors

LATHE—ENGINE—Pet's-Bridgeford 1942—60″ Swing x 30′ Centers x 40′ Overall. Double Compound—Each motor 5 H.P., 40 H.P. D.C. 230 volt. Like New.

DROP HAMMER—Cecostamp (Chambersburg) 1943. Air operated. Stroke 48″. Bed 66″ x 48″, Capacity 16,000 lbs. Wt. 47 Ton

SHAPER—Smith & Mills 25″—1945
Used 1 Month—Like New. P.R. Traverse.
Universal Table. Swivel Vise

IRONWORKER—Pels #16 Universal
Punch 1 1/16″ thru 5/8″. Shear 4 x 4 x ½″ Angles. Squares 1⅛″. Rounds 1½″.

SAW—NEWTON COLD CUT—Late.
32″ diam. Blade. 10″ diam. capacity
Q. C. Variable Speeds. 2 Motors A. C. Wt. 5 Ton

POWER PRESSES

PRESSES	TONS	STROKE	DIE SPACE	TYPE
Walsh #38	38	3″	13″ x 26½″	O.B.I.(1947)
Perkins #500B	50	3″	20″ x 27″	O.B.I., b.g.
(2) Bliss #58	20	5″	12½″ x 13½″	C Frame (1943)
(4) Ferracute C22	20	5½″	13½″ x 14″	Duplex, 2 Presses on 1 stand (1943) Hopper Feed
Torrington	50	2″ & 1″	23″ x 16″	Sub Arch, Dble. Action, Cam
Toledo #54	60	3″	18″ x 18″	SS with side shear
Bliss #75½	125	14″	24″ x 24″	SS Single Action b.g.
(2) Bliss #6	125	2″ & 5″	24″ x 32″	SS Dble or Single Action, b.g.(1942)
Cleveland	160	6″	28″ x 108″	Gap Frame
(2) Clearings (F1200-42)	200	1@26″-1@30″	38″ x 44″	SS Single Action b.g. (1942)
(2) Bliss #77½ (#308)	250	12″	30″ x 30″	SS Single Action b.g.
(3) Bliss #78½ (#310)	450	18″	52″ x 36″	SS Single Action b.g.
Birdsboro	1300	21″	29″ x 87″	Hydraulic, 1942
Ceco Stamp	16,000 lbs.	48″	66″ x 48″	Air Drop Hammer for die stamping (1943)

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KINGS COUNTY MACHINERY EXCHANGE
408 Atlantic Ave., Brooklyn 17, N. Y. Phones: TRiangle 5-5237, 5-5212, 5-5213

PRESSES

#408A Bliss Dbl. Action Toggle, 72x54 Bed, w/cushions, mtrs., controls.
#305 Bliss, 8" stroke, late, w/air cushions.
60 ton, Dbl. Crank, 5" stroke, 48x24 bed, late model Waterbury Farrel (3).
200 ton 12" stroke, 27x27 bed, Bliss 43'.
#56 Toledo 4" stroke, 21x21 bed, 15½" shut height.
35 ton, 4, 5, 6" stroke, latest type, pract. new, w/all accessories, Bliss $850.00 ea.
70-85 ton 4" stroke, 21x27 bed, 110 strokes per min., Bliss, latest type.
90-125 ton 4½" or 5" stroke, 60, 80, 110 (optional) strokes per min., late Type.
Inclinable, Walsh, new, 20 to 70 ton, immed. delivery from stock.

AUTOMATICS, LATEST TYPE

#0G B & S, late type
1" New Brit. Grd., 6 spdl.
1⅜" R4—New Brit. Grid.
1½ Cone—8 spdl. ('39)
9/16", 1", 1¼", 1⅝", 2", RA6 Acme Grid.
2¼ Cone 6 Spdl.
16" 8 spdl. Bullard Multaumatics, pract. new, (3) with some tooling, dbl. & sgl. index.
12" 8 spdl. Bullards, late type, lots of tooling.

HORIZ. BORING MILLS

3" Bar De Vlieg 6' bed, late type
3" Bar Univ. 6' bed, late type

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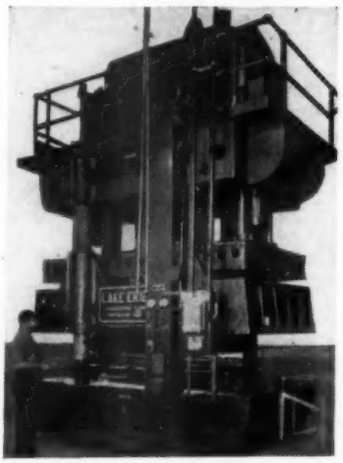

750 Ton Lake Erie Double Action Hydraulic
Max. Pressure: 750 tons
Max. Daylight: 49″ Min. Shut Height: 3″
Max. Stroke: 46″—main & pull back cylinders..
Max. Stroke: 46″—clamping cylinders
Max. Draw: 22¾″ Platen: 146″x81½″
Distance Between Columns: front to back 72″, right to left 55″

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DOUBLE STANDARD PLANERS MOTOR DRIVEN, 4 HEADS

120″x96″x26′ Cinci. Rapid power traverse
96″x96″x26′ Betts Rapid power traverse
72″x72″x25′ N.B.P. Power Elevation
54″x54″x18′ N.B.P. Power Elevation
20″—24″ Dill Vert. Slotter, Motor Drive
No. 31 Lucas Horizontal Boring Mill, Mtr. Dr.
10′—14′ Niles "Extension Type" Vert. Boring Mill, M.D.

LATE TYPE MACHINES

2H and 3H—3K Milwaukee Vertical Millers.
No. 2—4—1A Warner & Swasey Turret Lathes.
No. 61 and No. 715 Fellows Ext. & Int. Gear Shapers.
6″x18″ Norton Vertical Hydr. Surf. Grinder.
No. 25A—24″ Heald Rotary Surf. Grinder.
No. 55H—26″ Cochran-Bly Circular Saw.
1″ Oster Bolt Threader, Single Head.

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No. 6 W & S Turret Lathe, M.D.
No. 6 Whitney Hand Mill
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Potter & Johnston 5 DE Machine
1 spindle Gould & Eberhardt 36B Rougher
16" D. E. Whiton Gear Cutter motorized & rebuilt by the manufacturer.
Lodge & Shipley Duematic Lathe.

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AUTOMATICS

No. 2 Brown and Sharpe
1⅝" Greenlee, 6 Spdls (1941)
No. 61 New Britain 6 spindle 2¼"
No. 6 Brown & Sharpes

DRILLS

No. D-8 Colburn No. 6 Morse Taper
No. 1LMS—20"—6 Spdl L.G.
No. 2LMS—26"—2 Spdl. L.G. (1945)
No. 2LMS—26"—4 Spdl. L.G. (1942)
No. 2LMS—14"—4 Spdl. L.G.
No. 2MA6—15"—4 Spdl. Avey
No. 3MS—24"—1 Spdl L.G.
No. 3B—24"—6 Spdl. Edlund (1942)
No. 2—8 Spdl. Leland-Gifford
No. 4 BL Natco 36 Spdls.
7'-15" Col. American Full Universtal

GEAR MACHINES

No. 61-A Fellows Gear Shapers (1942)
No. 615-A Fellows Gear Shaper (1942)
No. 712 Fellows Auto Indexing (1943)
No. 72 Fellows Gear Shaper
No. 18-H Gould & Eberhardt
11" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter
No. 13 Gleason Univ. Tester

HOR. BOR. MILLS

No. 26 Defiance, 4½" bar
No. 31 Lucas, 3" bar
No. 3A Universal, 3" bar
Rockford, 3⅛" bar
No. 48-A Heald Borematic

GRINDERS

4"x12" Landis, Model H (1942)
4"x18" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
Norton Motor Driven Plain Grinders
6"x18" —— to —— 24"x240"

12'x36" Landis Type LCH Universal (1945)

No. 5—8"x24" Covel Hydr. Surf. (1941)
24"x24"x84" Mattison Hydr. Surf
No. 34 Abrasive Surface (1943)
No. 22—12" Heald Rotary Surface
No. 25A—24" Heald Rotary Surface (1943)

72A-3 Heald Internal Grinder
72A-5 Heald Internal Grinder
No. 5 Bryant Internal Grinder
No. 16-38 Bryant Internal Grinder
No. 24-26 Bryant Internal Grinder

10"x72" Colonial Broach Grinder

LATHES

13"x30" Pratt & Whitney
14"x6' Hendey
15"x5' Sebastian
16"x54" centers LeBlond
16"x78" centers American Pacemaker
18"x6' American
22"x48" centers Monarch
36"x30' Lodge & Shipley
36'—48"x16' Lehman Hydrotrol (1945)
48"x20' Simmons
50"x17' centers LeBlond (1942)

LATHES (Production)

8"x15" Sundstrand, Model B (1942)
8"x15" Sundstrand, Model D (1943)
8"x15" Sundstrand, Model E (1942)
10"x22" Sundstrand, Model AA (1943)
12"x18" Lipe Carbo
16"x21" Fay Automatic
16"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)

MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 08 Cincinnati Vert. (1942)
No. 2H Milwaukee Vert. (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Standard Milwaukee Vert.
No. 3 Cincinnati Vert. High Power
No. 1 U.S. Hand Millers
24" Cincinnati Production
No. 1-18 Cinn. Mfg. (1940)
No. 2—18" Sundstrand Electromil (1942)
No. M-18 Milwaukee Simplex (1942)
No. M-24 Milwaukee Simplex (1942)
Fitchburg Duplex Miller (1943)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
No. 56-90 Cinn. Hydromatic (1943)
No. 2 Hanson-Whitney Thread
4"x9" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x20" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
6"x132" Pratt & Whitney Thread Miller
10"x48" Hanson-Whitney Thread Miller (1942)
12"x24" Lees-Bradner, Model HT (1943)
4" Taylor & Fenn Spline, M.D.
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller
72"x48"x12' Ingersoll Adjustable Rail

MISCELLANEOUS

48"x36"x14' Gray Planer
Model H-7 Micromatic Hydro Honer
Model H-705 Micromatic Hydro Honer
Model H-2 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
No. 22-C Racine Shear Cut Hack Saw
8-M Wells Band Saw
No. 20 Bliss O.B.I. press
No. 2 V & O open back press
No. 0 Bakewell Tapper
Baush Tapper

TURRET LATHES

No. 2 B. & S. Screw Machine, Wire Feed
No. 3 Bardons & Oliver (1942)
No. 5 Warner & Swaseys (1942)
No. 5 Bardons & Olivers (1942)
No. 5 Foster, A.C. & Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼ Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

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34" King
72" Cincinnati
72" Niles Extra Heavy
84" Betts

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Avey & Allen 3, 4, 5, & 6 Spindles
Fox M.D. Type 138C Multi Spld. Late
Cincinnati-Bickford 3', 4', 5', & 6' Radials
Carlton 4' Radial
Niles-Bement & Pond 6' Radial

GRINDERS

Norton 6"x10"x36" Surface
Norton 15"x17"x72" Surface
Hill-Acme 18"x96"x24" Surface
Mattison 12"x16"x54" Surface
B. & S. Nos. 1, 2, 3, 4 Universal
B. & S. Nos. 5 & 10 Plain
Bryant Nos. 3B, 6 & 12 Internal
Norton No. 2 Cutter & Tool, M.D.
LeBlond No. 2 Tool & Cutter, M.D.
Cincinnati No. 2 & No. 3 Centerless
Cincinnati No. 3 Centerless Lapper
Fitchburg 36" Spline Grinder
B. & S. No. 13 Univ. & Tool, Late Type
Blanchard No. 16—26" & 16A
Heald No. 25-A 16" Rotary Surface
Heald No. 22—12" Rotary Surface
Abrasive Nos. 33, 3 & 34 Surface
Heald Nos. 70A & 72A Internal
P. & W. 14" Vert. B. B., M.D.
Norton Type "C" 6"x18" M.D. Hyd. Cyl.
Norton 10"x24" M.D. Plain Cyl.
Pratt & Whitney 9" M.D. Hyd. Gear
Thompson Model BB & B Hyd. Surface

LATHES

Johnson 36"x42' B.G.L.C.G. Engine
Monarch 12"x30" CK (swings 18")
Hendey Plain 12", 14", 16", 18" Yoke Head
Hendey 12"x5' Y. H. Fact. M.D.
Hendey 24"x8' M.D. Q.C.G. Eng.
Hendey 12"x5' M.D. Geared Head
Amer. 18"x12' B.G. M.D. Engine

MILLERS

Milw. No. 1½B Univ. M.D.
Cin. No. 2 Univ.
K. & T. No. 2HL, No. 4H Plain
Milw. No. 2B Double Overarm
B. & S. No. OY Production
B. & S. No. 3A Universal
Cin. Nos. 2 & 3 Vert.
Van Norman No. 3SP Plain
Becker Model C Vertical
B. & S. Nos. 3B & 5B Plain
Van Norman Nos. 0 & 10 Duplex
P. & W. 8", 10" & 12" Auto.
Cincinnati 18" & 24" Production
P. & W. 6"x14" Int. Thread
Lees-Bradner 6"x36" Thread
Cinn. No. 3 M.D. Plain
Milw. No. 1H-12 Mfg.
Potter & Johnson 2M Horiz. Auto.
Gorton No. 9J Vert. Late
B. & S. No. 21 Plain Auto.
Kempsmith No. 2 Univ.
Kempsmith No. 4, Plain Max. Late
LeBlond 3GH Plain Heavy

SHAPERS

Cincinnati 24" M.D. Crank Late
Hendey 32" M.D. Crank Late
Gould & Eberhardt 24" Crank
Gould & Eberhardt 16" M.D. Crank

PRESSES

W. F. 250 Ton Hobbing 3 Post
W. F No. 6 Knuckle Joint Coining
Bliss No. 304 M.D. S.S. Single Crank
Toledo 34P, M.D. Punch
Bliss No. 21 O.B.I. Power
W. F. No. 7 O.B. Dial Feed

SCREW MACHINES

B. & S. No. 00, 0, 2 Automatic 00G
Gisholt No. 3L Bar and Chucker
Gridley ⅞", 1¼", 1¾" & 2⅝" Model G
Cone 1¼", 3¼", 3½" & 4¾"—4 Spindle
Simmons No. 2 Micro-Speed Turret

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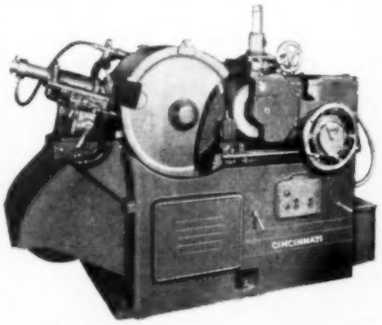

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No. 2 and No. 3 with motors and controls. All new in 1941 to 1943.

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GLEASON 12" Straight Bevel Two Tool Generator, complete with Gauges, Change Gears, Cabinet. Motor driven with AC Motor, All in Excellent Condition.

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1—#2 Savage Roller type Nibbling Machine, complete with circular attach. V-belt drive to 3 HP motor. Good condition.

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PRACTICALLY NEW
STAMCO PRESS BRAKE
126"x12 Gage, Toggle Arm Type
Condition Equal to New
Priced Very Reasonable
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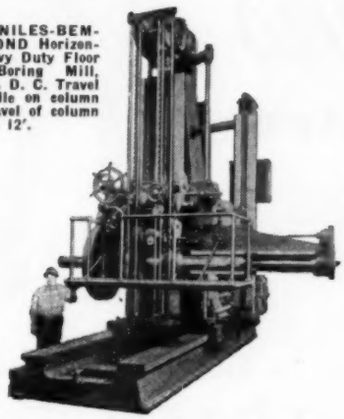
44" & 61" Bullard Maxi-Mills
72", 84" Niles-Bement-Pond
10' Betts, Three Heads
10' Niles-Bement-Pond
12' Niles-Bement-Pond
12' Betts, Extra Heavy
4" Bar Lucas Horizontal, Table Type
6" Bar Simmons Horizontal (1943)
2-Spindle, 6" & 3½" Jones Horizontal, Planer Table
5" Bar Sellers Floor Type
10" Bar Sellers Floor Type

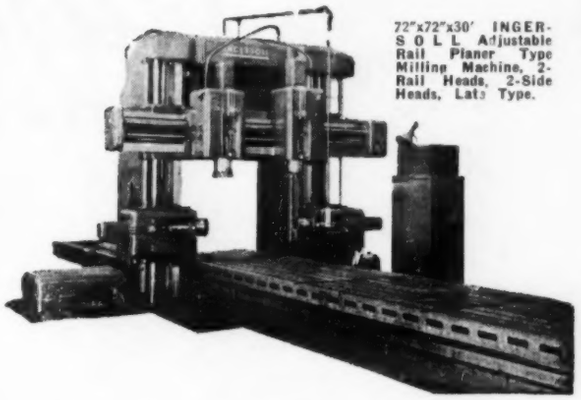
MILLING MACHINES

#3-A and #4-A Brown & Sharpe Universal
#3 and #4 Cincinnati Plain
#3-B and #4-B Kearney & Trecker Plain
#3-Kempsmith Plain
#5 Cincinnati Plain, Rectangular Overarm
#5 De Vlieg Bed Type Horizontal
#2 and #4 Cincinnati Vertical
#5 Reed-Prentice Vertical & Die Sinker
#9 Niles-Bement-Pond Heavy Duty Vertical
30"x36"x18' Newton Combination Planer Type and Slab

8" Bar NILES-BEMENT-POND Horizontal Heavy Duty Floor Type Boring Mill, 230 volt, D. C. Travel of spindle on column 12'. Travel of column on base 12'.



72"x72"x30' INGERSOLL Adjustable Rail Planer Type Milling Machine, 2-Rail Heads, 2-Side Heads, Late Type.



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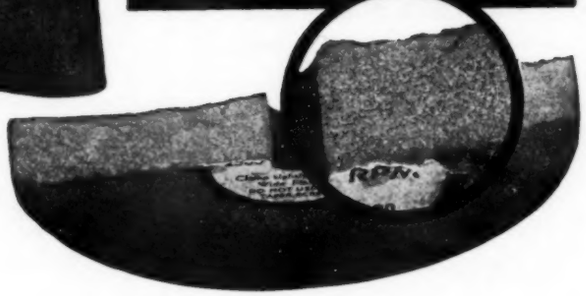

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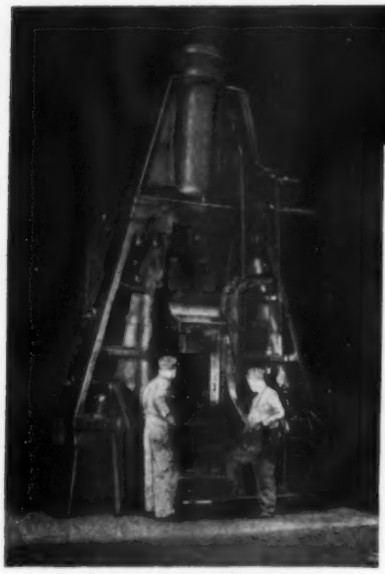

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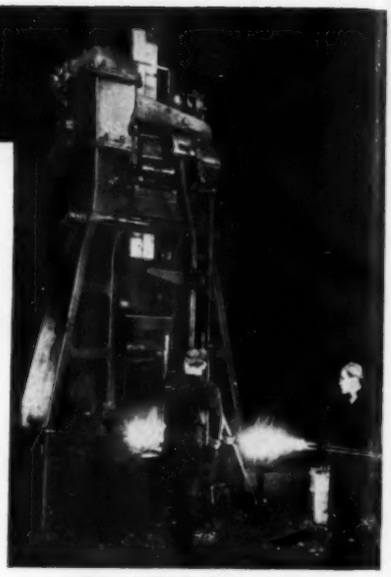

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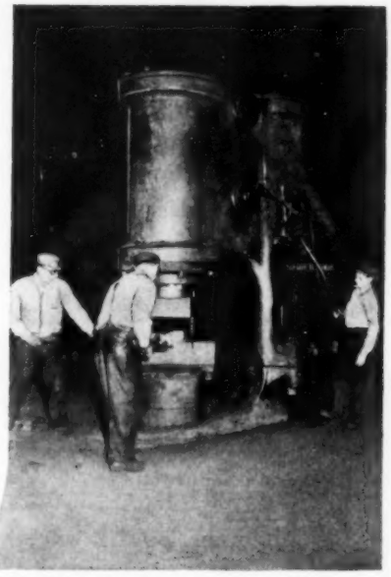

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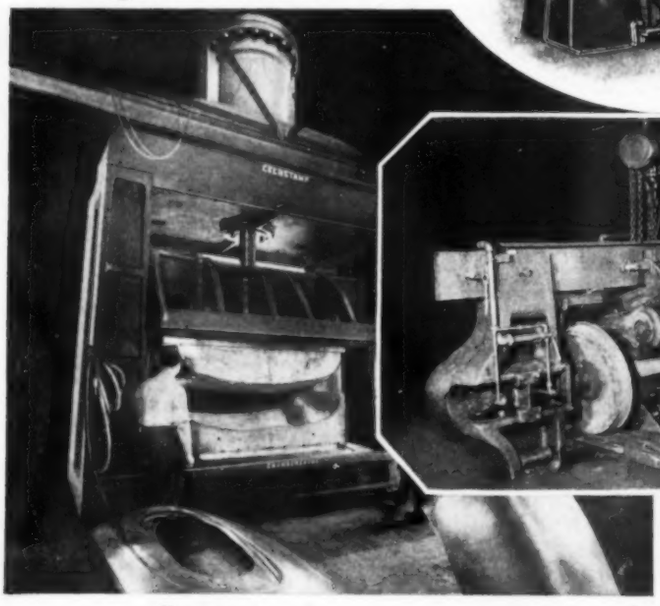

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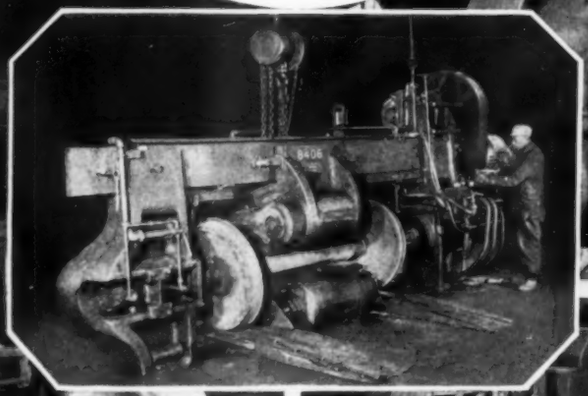

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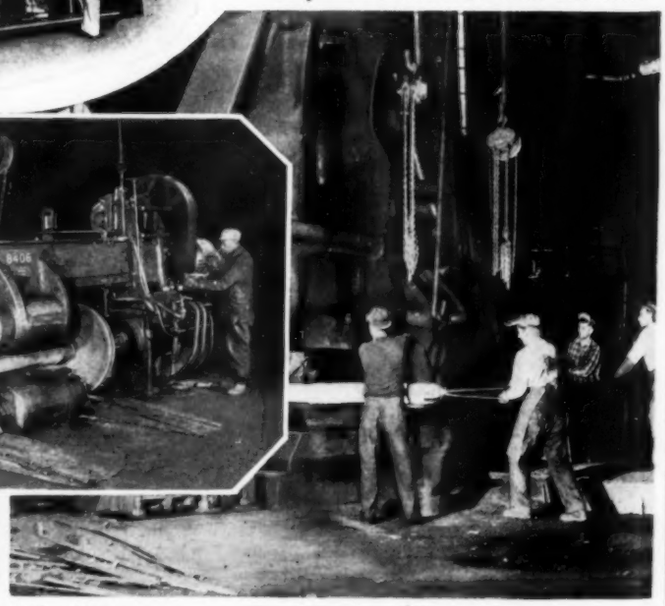

Double Frame Forging Hammer

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Underwood tackles HIGH BREAK-EVEN POINT

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ON THIS PART

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* RESULT

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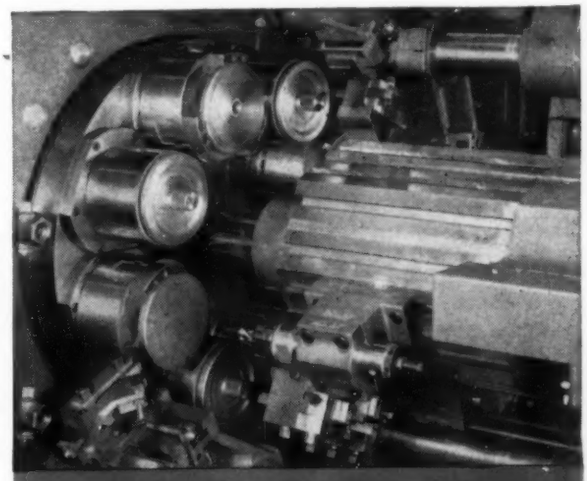
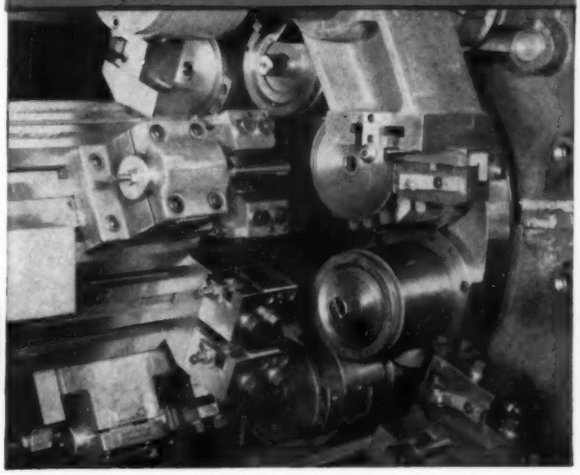
- Labor costs reduced 85%
- Quality of part greatly improved with tolerances held under 0.001"



The operations are finishing the O.D., facing both contoured sides, machining the I.D. of the hub, and trepanning wire grooves in one face. Simultaneous completion of both sides was made possible by arranging the machine for double index.



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The parts described in our new *Cost History* file were money-losers until New Britain engineering turned them into money-makers. Let us send you your free copy.

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848HD1

4 things you should know to make better forgings

1. The maximum forging temperature of the steel

2. How the ductility of the steel changes with varying temperatures

3. The force required to form the steel at varying temperatures

4. Whether the steel has uniform quality

—and here's how to find the answers

FOR the best results in forging, make sure you (a) have the complete forgeability data of the particular analysis used, and (b) use Timken alloy steel.

Using the hot-twist method, metallurgists of The Timken Roller Bearing Company have tested the forgeability of 97 analyses. Their findings have been compiled in a 112-page, Timken Company book, "Evaluating the Forgeability of Steels". It's yours for the asking.

Regardless of the analysis you use, Timken forging quality alloy steels assure uniform forgeability, superior surface and internal quality, and unvarying composition and response to heat treatment, from bar to bar and from heat to heat. That's why better forgings are made at less cost with Timken alloy steels. The Timken Roller Bearing Company, Steel & Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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